THE GLASS INDUSTRY

VOLUME 29, NUMBER 5, MAY 1948

BETTER RAW MATERIALS FOR THE GLASS INDUSTRY

By AXEL OTTOSON

Imperial Glass Corp., Bellaire, Ohio

It seems that during the last few years we have exhausted much of the high grade raw materials that were found in nature and were available to the glass industry. This is not meant to imply that we no longer have available excellent raw materials for making glass, but rather that no longer can materials be found in natural deposits which are pure enough for use in the glass industry without extensive treatment before becoming usable for manufacturing high grade glass.

European manufacturers on the other hand seem to have an abundance of excellent sand and other materials for making glass, although they are noticeably lacking in a good source of limestone, particularly dolomites. Table I* shows the composition of some high quality German sands which are available to the European glass industry. Moreover, since soda ash and pot ash are nearly equal in price in most European countries, most glass makers there lean toward the manufacturing of a pot ash lead glass and having excellent materials available to them are able to produce a glass of very high purity, especially with respect to the iron oxide content. This is the situation that confronts many of the American glass manufacturers, especially those attempting to produce high quality colorless glass. With the European manufacturers now invading American markets this situation is becoming increasingly important, particularly when protection by tariffs is becoming less effective.

Unfortunately many marketers of raw materials are unwilling to take the necessary steps to supply the industry with the high purity raw materials necessary in the manufacturing of optical, hand made and some machine made tableware. There is enough demand for materials of low purity to keep their plants in full operation and for this reason there is no particular need for them to cater to the needs of those requiring high purity raw materials. This is not meant to imply that those glass manufacturers not using high purity raw materials are producing an inferior quality of glass since the glasses which they produce do not require high transmission of light, exceptionally clear crystal color, or similar properties found in high grade crystal glassware. In fact, lack of freedom from iron is not a detrimental factor in such glasses, but in fact beneficial in many instances.

To illustrate the obvious carelessness and indifference experienced with some suppliers of materials, let us consider the following examples:

In one case a whole carload of sodium nitrate received by a glass factory was found to be defective. The batch mixers did not recognize immediately this condition and glasses melted using this sodium nitrate resulted in consistently bad glass. When a close investigation was made, large flakes of iron oxide scale were found in every bag of sodium nitrate. Further use of this nitre was impossible and it had to be sold as a fertilizer to the nearby farmers. Another instance where an investigation was conducted to determine the cause of glass difficulties revealed that the feldspar being used contained large quantities of mica, silica and clay in addition to the regular feldspar, but, worst of all, the particle sizes of these impurities were so large that they could not be dissolved in the glass during a reasonable melting period. This material also had to be discarded in order to avoid further recurrences of their difficulty. Another example of difficulties confronting the industry is in connection with sand. During the years prior to 1942 silica sand from a certain source of supply would constantly analyze between .015 to .02 per cent Fe_2O_3. Now the sand from this same source is running as high as .035 per cent Fe_2O_3 and occasionally higher. Similar experiences can be found with limestone and feldspar. In all these cases only crude methods of purification are employed by the suppliers, and although they produce raw materials satisfactory for certain types of glass, they are no longer usable for glasses for optical purposes or very fine table glassware made by hand or machine.

The following are but a few examples of what can be done in the way of producing high purity raw materials and are just mentioned as specific examples and are in

Presented before the Ninth Conference on Glass Problems, University of Illinois, Urbana, Illinois.

TABLE I

Chemical Analysis of Some High Quality German Sands

1. Dörentruper crystal glass sand—trade marked O.P.C. (1926-1932)
2. Crystal glass sand from Duingen (1930-1932)
3. Special first grade sand from Hohenbocka (1923-1934)
4. Crystal glass sand from Frechen (near Cologne) (1930-1931)
5. Crystal glass sand O.C. from Walbeck (1926-1930)
6. First grade sand from Reinsdorf (near Wittenberg) (1925-1932)

A Washed Sand

	1	2	3	4	5	6
SiO_2	99.79	99.74	99.77	99.74	99.70	99.07
TiO_2	0.038	0.03	0.034	0.03	0.035	0.035
Al_2O_3	0.092	0.09	0.070	0.13	0.161	0.54
Fe_2O_3	0.008	0.011	0.012	0.012	0.013	0.019
K_2O+Na_2O	0.040	0.040	0.055	0.040	0.043	0.19
CaO	0.023	0.026	0.057	0.038	0.041	0.09
MgO	0.004	trace	0.006	0.005	0.007	0.02
Ig. Loss	0.065	0.08	0.066	0.02	0.101	0.10
	100.06	100.02	100.07	100.01	100.10	100.06
Sludge	0.12	0.13	0.17	0.11	0.14	0.19

B Unwashed Sands

SiO_2	99.24	99.38	98.32
TiO_2	0.13	0.04	0.03
Al_2O_3	0.37	0.28	1.10
Fe_2O_3	0.033	0.061	0.031
K_2O+Na_2O	0.11	0.05	0.038
CaO	0.08	0.05	0.06
MgO	0.01	0.01	0.01
Loss on Ign.	0.14	0.14	0.18
Clay and sludge.	0.40	0.51	1.48

no way intended as an endorsement of these materials over other manufacturers since there are no doubt others besides those mentioned who are producing a very fine grade of raw material for the glass industry. Good feldspars are increasingly difficult to find in nature. They are contaminated with many materials which either reduce their alumina oxide content or increase their iron oxide content greatly. A feldspar company recognizing this condition has invented a floatation process by means of which they are able to produce a very good grade of feldspar. They have available a rock containing chiefly soda feldspar, quartz, biotite, and muscovite, and some other materials not identified. As such the material is almost worthless, but it is mined, crushed, and then by selective floatation the minerals are separated very effectively. After this the material is treated by high intensity magnetic separation to effect a final purification to separate out some minerals which have escaped the floatation process but are magnetic enough to be removed by this process. By this means soda feldspar of very high purity, having iron as low as .05 per cent and of uniform quality is produced. A most interesting by-product, however, is a pure silica sand having an iron oxide content of .007 per cent and even lower, which is very suitable for producing optical and other special glasses. The mica which contains a good portion of the iron is completely separated from the other materials and sold for various purposes. Thus from a mixture of minerals of little or no commercial value they have been able to produce three highly refined products of considerable value to industry.

Another very interesting product is sand produced by a company in Ohio. This material is extremely low in its iron oxide content, some anlyses having been made and found to be as low as .002 per cent iron oxide. The exact method of producing this material is still restricted information, but it is my understanding that regular glass sands are heated to a high temperature in an atmosphere of chlorine gas which process removes the iron oxide contamination. At the present time this product is too expensive for commercial glasses, but it is excellent for optical glasses where cost is not such an important factor.

Notable among producers of extremely pure raw materials for glass is the Diamond Alkali Company who produce the well known Non-Fer-Al for a source of calcium oxide.

Once having refined a raw material to extreme purity, or manufactured one as a pure chemical, it is necessary to take adequate precautions in packaging these materials so that they will not become contaminated during shipment. Many box cars today are not fit for shipping raw materials unless they are bagged in heavy walled paper bags or similar measures to prevent their contamination.

So we find that the time has passed when merely digging the material from the earth and marketing it was sufficient. Raw materials will have to be manufactured or refined to a high degree of perfection to meet the needs of the glass industry in the future.

Since sand is the major ingredient in glass, we have turned our attention to the possibility of purifying sand in our own plant. Steuben Glass Works is well noted for producing a very fine crystal glass, the beauty of which is due to extreme purity. To achieve this we are told that very elaborate devices are employed to purify the raw materials, particularly sand, before attempting to melt them into glass. If a glass is made low enough in iron, a decolorizer is hardly needed, and the sparkle and transmission of the resulting glass is a pleasure to behold.

Experiments were recently conducted to learn what might be accomplished in the way of purification by magnetic means. The results of these tests so far are somewhat confusing since high intensity magnetic separation through induced rollers does not seem to perform as well as a conventional magnetic drum or pulley. These discrepancies may be due to the design features of the equipment rather than to the type of magnetic field employed.

TABLE II

Analysis of Sand Treated by Magnetic Separation

Original Sands	Induced Roll		Magnetic Drum	
Fe_2O_3	Per Cent of Tailings	Fe_2O_3 in Treated Sand	Per Cent of Tailings	Fe_2O_3 in Treated Sand
0.018	1.24	0.015	0.18	0.012
0.021	3.5	0.013	3.25	0.012
0.021	8.0	0.013	7.52	0.010
0.03	1.97	0.017	0.14	0.017
0.043	5.21	0.017		

Thus it appears possible to purify sand by simple magnetic separation to meet rather rigid specifications. The difference in the results from the two types of separators may be explained as follows:

The induced roll or high intensity type separator permits the sand to fall vertically onto a number of rolls of small diameter (about 4") which are highly magnetized by induced magnetism. The sand falling in this manner passes through the magnetic field very quickly and has a tendency to bounce upon striking these rolls and is directed away from the intense portion of the magnetic field. A knife edge is employed under each roll to cut off that portion which is magnetic and deflected away

(*Continued on page* 288)

PACKAGE HANDLING IN GLASS PLANTS

By PAUL J. BARCUS

Owens-Illinois Glass Co., Toledo, Ohio

In accepting this assignment, I agreed to discuss packages, their design and quality factors to protect glass products and their contents; also to touch on handling problems as related to the packages.

It should not be amiss before proceeding to state that it is timely that packaging be given a place in technical research and study. American industry has made amazing progress in the efficient production of goods, thanks to the application of technical knowledge. The glass industry has not been lagging in keeping pace with this progress. The net result is that the cost of manufactured products is being kept at reasonable levels, considering the major advances in costs of raw materials and labor.

If we are to seriously analyze the high damage claims reported by our transportation industry, we must conclude that either packaging is not keeping pace with improvements in industry as a whole, or our transportation systems are inefficient in the protection of their freight traffic. It is probable that increased speed has not been accompanied by proportional caution. My observation is that L.C.L. freight is an example of extremely rough handling.

Supposing that packaging and transportation were a combined business. The nearest we have to it are the overland moving van companies. They come into your home and pick up your belongings without any packing on your part, and set them down in another location, frequently across the continent, with a nominal loss or damage. The point is, do they spend an extra amount of time and expense in packing? Definitely not. It is a combination of proper preparation and careful handling.

We do not have a combined packing and transportation industry for manufactured products: one that will provide necessary protection and careful handling properly balanced to meet the needs. Until that ideal situation arises, products should be packaged to be reasonably well protected against damage from an unknown degree of rough handling and normal impacts in transit.

In our study and research of required protection for products in glass and glass items, our greatest problem is to determine the hazards packages will encounter. We have an opinion, but it is not substantiated by positive facts. We do not think the facts are available. We must depend upon average results.

It is common knowledge that railroad cars are loaded heavier than in the past. Freight trains consist of more cars and travel at greater speeds and, last, the morale of manual labor is not that which is to be desired. This all adds up to greater hazards for products in transportation.

There is a great need, and the time is opportune, to make a cooperative scientific approach to this problem. It is not to be inferred from what has been said that packages should be made protective enough to meet the more hazardous situations, but instead manufacturers should determine what protection is reasonable and be able to prove their conclusions.

Present packaging and distribution costs are now too great. Every product has an economical limit on package cost. On low cost products it is most difficult to attain the ideal cost ratio.

At present, carriers are fostering a performance standard for packages which would replace present detail specifications in Rule 41 of Consolidated Freight Classifications. It only remains for shippers and railroad carriers to agree on the standard of performance. When shippers and carriers agree on a standard of performance in packages, much progress will have been made in solving their present mutual problem. It will open a field for the development of scientific design in packages.

As it is well known, Rule 41 of Consolidated Freight Classification refers to fibreboard boxes. Because the glass industry uses fibreboard boxes almost exclusively, our further remarks will be about fibreboard boxes, and I will refer to them as "boxes." I will discuss the materials used in these boxes, their design to provide the maximum protection to glass items, their proper fabrication, assembly, closing and handling and last, stowing in railroad cars.

The rail carriers have blamed much of their high damage claim situation on fibreboard boxes. They have proposed more inner packing which would not solve the problem and also without due proof of the need, they proposed heavier materials.

It is common knowledge that boxes produced for the last five or six years have not all had a reasonable degree of quality. In fact, some were very poor and should not have been used. Their lack of quality was not all in the Mullen test strength.

Quality here should be considered an element or factor in the box, permitting it to perform its proper function as a box and to retain and protect its contents during warehousing and transportation. Fibreboard boxes can be produced that will perform satisfactorily without resorting to heavier materials and abnormal increases in cost over normal market variations when made of adequate materials, properly designed, correctly fabricated and when not subjected to too much abuse.

One of the common causes for the failure of a box to perform is the use of inferior corrugating media, commonly termed as "bogus." The production of this material in 1944 was five times that of 1942, or specifically 446,517 tons in 1944 and only 86,969 tons in 1942. These figures were developed by the United States Department of Commerce and are quoted from an article by Mr. W. B. Lincoln, Technical Manager of Inland Container Corporation, published in *Shipping Management,* November, 1947 issue.

Unless the above material has the proper quality, boxes made from it lack the necessary rigidity required in a box. Some of the other grades of corrugating media are lacking in quality factors. Two other common causes for failure are improper fabrication of even good materials and improper design of boxes. Not all fibreboard box manufacturers have sufficient knowledge of the quality

Paper presented before the Ninth Conference on Glass Problems, University of Illinois, Urbana, Illinois.

requirements of a box, or what correct design will accomplish. Those that have the knowledge should learn more. Here is an opportunity for scientific research.

There is a need for a standard of quality in fibreboard boxes. Good fabrication and correct box design add little to those below a specific degree of quality. A quality box requires a combination of rigidity, good bonding of the facings to the corrugating media, an adequate tear strength, and a factor to resist moisture absorption. At present weather proof boxes are available, but a lower cost is needed.

Let us itemize what can be done to improve boxes in relation to our opinion of their importance: 1) Better corrugating media—one that will add rigidity to a box. 2) Better fabrication, maintaining a uniform thickness of combined board; more uniform bond of facings to corrugating media; less crush in fabricating operations, corrugating, printing, taping and assembly. 3) Correct design, proper cell sizes, fit of inner packing in outer box and related parts. 4) Conformance to specifications. 5) Proper care in assembly of boxes with inner packing.

Commercial box testing laboratories have accentuated the compression strength of boxes in the vertical (top to bottom) and horizontal (end to end) directions, and have developed standards for various sizes and materials; but for empty boxes.

In the glass container industry there is a need for this same type of research and study, but the inner parts should be included in the box when tests are made. They are definitely a part of the box and all serve a useful purpose when correctly used. Furthermore, these inner parts, or inner packing by whichever term you may use, are fast becoming recognized as quite important for the packaging of glass items. One could even go so far as to build inner packing to a degree of protective qualities that it could be successfully enclosed in a bag or wrapper for reasonable protection.

The proper designing of packages is the science of providing cushioning suspension and protection for a product so that shocks or impact forces will be minimized to reduce possibilities for damage to item packed. We often state that damage occurs either because of movements within the package or impacts of one package against the other. Adequate inner packing takes care of the first and rigidity and compression strength in the package minimizes damage in the latter.

A common fault in package designing is to supply super-protection in strength of the box itself and to a degree disregard the inner protection. However, assuming that the boxes supplied the packing department are of a required quality in every respect, they can be materially impaired in this quality by malpractices in assembly, flap closing, warehousing and shipping.

A very large percentage of boxes now used by glass container plants are re-shippers which packers use for shipping their products, and these boxes are frequently handled and are required to do a multiple service. It is extremely important that they be not abused or their qualities will be severely impaired.

To be brief, following are the factors that impair box quality or efficiency: 1) Disturbing rigidity of board in box or inner packing as assembly is being made. 2) crooked or incomplete flap closing in sealing. This distorts box design and makes for naught what has been done in developing proper design and also reduces compressive strength. 3) Insufficient sealing resulting in inadequate retaining qualities; crush in sealing which reduces compressive strength. 4) Handled too severely at any time which may cause indentations, snags or crush of flutes.

Storing and transporting on pallets is definitely before you. Although we will not attempt to discuss the mechanics of a palletized operation, we will discuss how this may affect box performance and box design.

Pallets impose a static pressure on fibreboard boxes, and a settling of the stack will occur. The degree of settling will depend upon height of flutes in the corrugated board, the quality of the box, and the design of the box. It naturally follows that the least possibility of settling is achieved by establishing safeguards against this hazard. This can be attained by using B flute in outer boxes—when this type of flute is adequate, more rigidity in corrugating media in boxes, less absorption of moisture by keeping warehouse as dry as possible and last, by reducing extra depth in the package to a minimum.

Pallets should also be designed so that the static load is equally distributed over the boxes below, and cross members on pallet should be of proper width. Proper stacking of boxes on pallets is very necessary. Even the best of boxes will not withstand a severe static load under moist or adverse conditions. Pallets have made it necessary that users of glass containers standardize on the packages they use. This creates a need for glass manufacturers to standardize on competitive boxes.

Much has been written and said on the proper methods to stow boxes in cars. The methods used to secure best results depend much upon the size of boxes, the support within the box, the compressive strength of the box, and similar factors. Here again improper stowage in cars can counteract much of the advantages of the quality in a box that makes it satisfactory for additional trips.

Any method of stowage that will reduce the individual crushing impacts a box receives is advisable. It is obvious that the car being loaded should be cleaned of all objects that will tend to damage cartons, such as residue of previous loadings, protruding nails, anchor plates from previous steel strapping, etc.

In general, boxes should be stowed reasonably snug and, unless a block method of loading is used and every few layers of boxes reversed, side or end walls of box should be in line, paralleling the length of the car. Car door recess should be properly closed and stowing in doorway area should be in conformity with good practice.

It may be considered by some that this paper is too elementary. However, with this subject, it is the simple and obvious matters that are too often overlooked.

It has been suggested that it should be specified where research is advisable on packages and handling problems in the glass industry. Therefore, in conclusion, it is submitted that research be centered on:

1) A study of the improvement of packages in general and corrugating media for corrugated boxes in particular. By a knowledge of test procedures and frequent tests, it may be learned that by slight alteration, and at a lower cost, a better protective package will result.

2) An engineering study on products packed to determine if design can be altered to make product less difficult and costly to package.

3) A better understanding of the hazards in transportation, and how these hazards can be alleviated.

WAGE STRUCTURE IN GLASSWARE

By MARION HAMMETT

The glassware industry, as readers of this magazine know, has a long history of successful labor relations. This has often brought up the question of whether the fact that employers and workers have been successful in their collective bargaining, has meant a uniformity of wage rates in the industry.

It must be remembered, however, that it is necessary to distinguish between a uniformity of rates and the actual earnings of workers in the industry. Although piece rates may be uniform, the actual earnings depend on the workers' capacity to produce, variations in the age and efficiency of machines from plant to plant and in the efficiency of management.

A study of wages in the glassware industry during January, 1947, was made by the U. S. Bureau of Labor Statistics. This study shows the wage structure of the industry and the geographic differences in the earnings of the workers in glassware.

A number of factors contributed to the difference in earnings. The fact that two-fifths of the workers in the industry are paid on an incentive basis leads to considerable variation in average hourly earnings even for the same jobs, despite the comparative uniformity in union scales.

Before discussing the various earnings in the different occupations of the glassware industry, it should be noted that this article refers only to pressed or blown glassware and not flat glass, for instance.

The government study covered establishments manufacturing glass containers, tableware, technical and scientific glassware, glass brick, glass cooking and ovenware, lighting glassware and other pressed or blown glass products except optical lenses, fiber glass, and complete electric light bulbs and complete lighting fixtures.

The production processes in the glass products industries have been extensively mechanized for some time. The manufacture of narrow and wide-mouth containers for bottling and packing is carried on mainly on forming machines. Also, pressed ware is extensively produced on a machine basis. Hand blowing, however, is still an important operation on finer quality containers for perfumes and cosmetics and for various types of tableware and other glass products. These differences in processes play an important role in wage rates.

Higher earnings were reported in plants mainly engaged in producing machine-blown glass and pressed ware than in those producing hand-blown glass. This difference is due partially to the differential between machine and hand plants provided in union agreements. There was, however, no consistent variation in earnings

TABLE I

Occupation and sex	UNITED STATES[2]				MIDDLE ATLANTIC*				BORDER STATES†				GREAT LAKES‡			
	Establishments with				Establishments with				Establishments with				Establishments with			
	251 or more workers		8 to 250 workers		251 or more workers		8 to 250 workers		251 or more workers		8 to 250 workers		251 or more workers		8 to 250 workers	
	No. of workers	Avge. hourly rates	No. of workers	Avge. hourly rates	No. of workers	Avge. hourly rates	No. of workers	Avge. hourly rates	No. of workers	Avge. hourly rates	No. of workers	Avge. hourly rates	No. of workers	Avge. hourly rates	No. of workers	Avge. hourly rates
MEN																
Assemblers, cartons	952	$0.88	92	$0.85	484	$0.89	41	$0.87	34	$0.84	12	$0.81	200	$0.94	16	$0.88
Batch mixers	576	.97	156	.90	241	1.00	33	1.05	44	.99	30	.88	134	1.03	28	.96
Blowers	562	2.23	326	2.18	315	2.38	63	2.56	146	2.09	164	2.34	101	1.94	43	1.25
Carry-in boys	1,789	.91	573	.84	987	.94	128	.85	336	.79	232	.75	463	.95	136	.90
Fillers	297	.97	68	.97	180	.99	16	1.05	39	.91	26	.87	69	.93	14	.88
Farming-machine operators	3,018	1.49	302	1.32	1,174	1.47	90	1.31	246	1.50	50	1.24	1,004	1.57	94	1.41
Gatherers	1,248	1.72	515	1.86	598	1.85	147	2.12	349	1.52	210	1.75	301	1.70	68	1.95
Grinders, glassware	507	1.07	109	1.04	317	1.06	50	1.06	81	1.09	26	1.06	110	1.09	9	(3)
Lehr tenders	476	1.05	81	.91	232	1.06	28	1.02	44	.96	12	.81	117	1.02	24	.87
Maintenance men	295	1.13	71	1.05	134	1.10	32	1.07	24	1.42	8	1.13	74	1.18	12	.97
Mechanics, maintenance	440	1.34	25	1.19	189	1.28	3	(3)	38	1.34	3	(3)	93	1.33	11	1.16
Mold cleaners	649	.99	108	.87	283	1.01	22	.96	75	.95	39	.81	197	1.02	23	.90
Mold makers, metal	1,272	1.57	104	1.61	480	1.54	26	1.55	267	1.63	20	1.58	408	1.54	38	1.52
Pressers, glassware	533	1.80	158	1.99	183	1.92	37	2.04	168	1.64	62	1.82	182	1.85	49	2.13
Selectors	2,341	1.01	246	.95	1,191	1.01	139	.93	99	1.15	14	.90	547	.97	81	.99
Tankmen	639	1.10	190	.95	265	1.17	43	1.05	74	.96	49	.96	209	1.07	44	.95
Truckers, hand	1,238	.94	192	.81	677	.94	48	.85	108	.91	54	.78	372	.96	13	.86
Warming-in boys	754	.90	95	.87	153	.84	30	.88	432	.91	22	.82	169	.95	26	.85
Wrappers	354	.96	118	.89	89	.89	16	.90	—	—	—	—	265	.98	100	.89
WOMEN																
Assemblers, cartons	1,316	.87	223	.70	468	.86	6	(3)	219	.87	32	.70	478	.87	10	.75
Carry-in girls	397	.89	70	.78	44	.80	28	.86	111	.77	34	.69	242	.95	8	(3)
Cutters, decorative	107	1.13	58	1.14	20	1.17	—	—	52	1.18	58	1.14	17	1.37	—	—
Grinders, glassware	210	.80	144	.72	103	.81	19	.74	64	.82	74	.71	43	.77	32	.76
Painters, brush	262	.98	47	.93	81	1.24	19	1.30	40	1.20	28	.68	108	.75	—	—
Selectors	7,509	.86	546	.77	2,934	.83	135	.85	1,280	.88	140	.73	2,513	.85	62	.75
Wrappers	1,621	.78	272	.74	387	.77	39	.69	58	.85	46	.66	1,177	.78	132	.72

[1]Excludes premium pay for overtime and night work.
[2]Includes data for other regions in addition to those shown separately.
[3]Insufficient number of workers to justify presentation of an average.
*Middle Atlantic—New Jersey, New York and Pennsylvania.
†Border States—Delaware, District of Columbia, Kentucky, Maryland, Virginia and West Virginia.
‡Great Lakes—Illinois, Indiana, Michigan, Minnesota, Ohio and Wisconsin.

among plants primarily engaged in producing glass containers, tableware and other products.

Despite the extensive mechanization in this industry, considerable skill and ingenuity is still required in some operations and wide variations in earnings, therefore, exist between occupational classifications, ranging from an average of 74 cents for women markers and mold cleaners to $2.21 for blowers in all divisions combined.

Relatively high average hourly earnings were also received by pressers, forming-machine operators, gatherers, mold makers and decorative cutters. Within occupations earnings of individual workers were considerably dispersed about the average. For example, gatherers in Fayette, Washington and Westmoreland Counties, Pennsylvania averaged $2.08 while individual operators earned from 80 cents to over $3.50 an hour.

Women averaged considerably less than men—84 cents and $1.14 respectively for all plant workers studied. In large measure this difference in average earnings is the result of the fact that women were employed primarily in the less skilled jobs. Differences in average earnings between men and women occurred in the occupations in which both were employed. Often differentials in rates for men and women were provided in union agreements in the industry.

Higher earnings were found in large establishments, most of which are primarily engaged in machine production of glass, with its higher union scales, and in large communities and among incentive workers. Work-

(*Continued on page* 290)

TABLE II

Average Hourly Wage Rates (Straight-time Hourly Earnings) [1]for Plant Workers in Selected Occupations in Glassware Establishments, United States and Selected Regions — January, 1947

Occupation and Sex	UNITED STATES[2]		MIDDLE ATLANTIC		BORDER STATES		SOUTH-EAST*		GREAT LAKES		SOUTH-WEST†		PACIFIC‡	
	No. of workers	Avge. hourly rates	No. of workers	Avge. hourly rates	No. of workers	Avge. hourly rates	No. of workers	Avge. hourly rates	No. of workers	Avge. hourly rates	No. of workers	Avge. hourly rates		
MEN														
Assemblers, cartons	1,044	$0.88	525	$0.88	46	$0.83	154	$0.74	216	$0.94	59	$0.77	42	$1.22
Batch mixers	732	.96	274	1.00	74	.94	82	.74	162	1.02	93	.80	42	1.21
Blowers	888	2.21	378	2.41	310	2.22	—	—	144	1.74	35	1.65	16	2.97
Carry-in boys	2,362	.89	1,115	.93	568	.78	—	—	599	.93	33	.72	(4)	(4)
Cutters, decorative	210	1.40	56	1.58	83	1.43	—	—	58	1.18	—	—	8	(3)
Electricians, maintenance	354	1.29	157	1.27	29	1.41	18	1.07	101	1.28	17	1.20	26	1.49
Etchers	43	1.09	25	1.09	6	(3)	—	—	12	1.01	—	—	—	—
Fillers	365	.97	196	1.00	65	.90	—	—	83	.92	—	—	12	1.19
Forming-machine operators	3,320	1.48	1,264	1.46	296	1.45	154	1.33	1,098	1.55	214	1.24	274	1.56
Gatherers	1,763	1.76	745	1.90	559	1.61	—	—	369	1.75	50	1.54	30	1.94
Grinders, glassware	616	1.06	367	1.06	107	1.07	—	—	119	1.08	9	(3)	8	(3)
Janitors	839	.86	287	.88	165	.84	20	.65	300	.85	26	.75	32	1.12
Lehr tenders	557	1.03	260	1.06	56	.93	12	.88	141	.99	25	.88	60	1.20
Machinists, maintenance	601	1.38	321	1.36	25	1.40	12	1.31	200	1.40	15	1.25	20	1.65
Maintenance men	366	1.11	166	1.09	32	1.34	6	(3)	86	1.15	68	.98	8	(3)
Mechanics, maintenance	465	1.33	192	1.27	41	1.33	10	1.28	104	1.32	17	1.32	74	1.53
Mold cleaners	757	.98	305	1.00	114	.90	32	.69	220	1.01	49	.89	34	1.18
Mold makers, metal	1,376	1.57	506	1.54	287	1.62	26	1.59	446	1.54	33	1.50	78	1.82
Painters, spray	100	1.24	60	1.10	10	2.39	—	—	30	1.14	—	—	—	—
Polishers, glassware	223	1.05	124	1.10	28	1.14	—	—	62	.93	6	(3)	—	—
Pressers, glassware	691	1.85	220	1.94	230	1.69	—	—	231	1.91	2	(3)	8	(3)
Printers	64	1.05	19	.91	22	1.08	—	—	23	1.16	—	—	—	—
Selectors	2,587	1.00	1,330	1.00	113	1.12	114	.84	628	.98	122	.90	172	1.20
Stock clerks	385	.99	204	.99	32	.92	16	.75	93	.98	8	(3)	30	1.26
Tankmen	829	1.07	308	1.16	123	.96	36	.92	253	1.05	54	.84	42	1.22
Truck drivers	242	1.01	120	1.02	38	1.03	8	(3)	46	.98	10	.66	20	1.27
Truckers, hand	1,430	.92	725	.93	162	.87	32	.75	385	.95	102	.80	20	1.08
Truckers, power	768	1.00	241	1.05	41	1.11	30	.87	365	.92	28	.92	50	1.28
Warming-in boys	849	.90	183	.84	454	.90	—	—	195	.93	3	(3)	14	1.05
Watchmen	511	.85	202	.85	95	.83	20	.66	131	.87	32	.70	20	1.10
Working foremen, processing depts.	981	1.39	338	1.37	182	1.33	52	1.22	250	1.42	53	1.49	94	1.57
Wrappers	472	.94	105	.89	—	—	—	—	365	.96	—	—	—	—
WOMEN														
Assemblers, cartons	1,539	.84	474	.86	251	.85	56	.56	488	.87	198	.75	72	.99
Carry-in girls	467	.87	72	.83	145	.75	—	—	250	.95	—	—	—	—
Cutters, decorative	165	1.13	20	1.17	110	1.16	—	—	17	1.37	18	.70	—	—
Grinders, glassware	354	.77	122	.80	138	.76	—	—	75	.76	11	.60	8	(3)
Janitors	169	.80	91	.81	7	(3)	—	—	54	.76	3	(3)	14	.96
Markers, cut ware	55	.74	25	.69	16	.87	—	—	14	.68	—	—	—	—
Mold cleaners	161	.74	36	.73	22	.71	—	—	100	.75	3	(3)	—	—
Painters, brush	309	.97	100	1.25	68	.99	—	—	108	.75	33	.79	—	—
Painters, spray	177	.94	105	.92	20	.97	—	—	52	.94	—	—	—	—
Selectors	8,055	.85	3,069	.83	1,420	.86	26	.70	2,575	.85	499	.79	392	1.04
Transferrers	179	.83	53	.79	22	.84	—	—	104	.84	—	—	—	—
Working foremen, processing depts.	118	.89	49	.86	19	.84	—	—	38	.90	—	—	12	1.08
Wrappers	1,893	.77	426	.77	104	.77	—	—	1,309	.77	—	—	(4)	(4)

[1]Excludes premium pay for overtime and night work.
[2]Includes data for other regions in addition to those shown separately.
[3]Insufficient number of workers to justify presentation of an average.
[4]Data are not shown in order to avoid disclosing information for an individual establishment.
*Southeast—Alabama, Florida, Georgia, Mississippi, Tennessee, North Carolina and South Carolina.
†Southwest—Arkansas, Louisiana, Oklahoma and Texas.
‡Pacific—California, Nevada, Oregon and Washington.

BOTTLES THAT PACKED A WALLOP

By CLARENCE T. HUBBARD

The "throw back" to the Gay Nineties so successfully radiated by the Broadway musical smash "High Button Shoes," the Grable movie "Mother Wore Tights" and the perennial "Life With Father" bring a wisp of nostalgia for the bottles of the century past that packed a wallop.

Grandpa carried some of his liquor in a flask shaped as a clam. Grandma used a bottle formed and curved as an oyster for meat sauce; after dinner brandy was poured from a dark amber glass container moulded as a violin with the cork at the bottom, the part the artiste tucks under his chin.

These are known as Character Bottles—bottles shaped to memorialize persons, objects, animals and events. The Van Dunck Genever, a "Schnapps" bottle from upper New York, a Ware and Schmidt product, cast in deep red amber as a coachman in a great coat and holding a long pipe, is a collector's item today worth about $20.

These bottles packed a wallop. They were good advertising, serving as unusual containers to attract buyers' attention, to trade-mark their contents in many instances, and were seldom thrown away! In fact, the Character Bottle has not entirely vanished.

G. F. Heublein still distribute Russian Kümmel in white and black "bear" bottles. The bear sits on his haunches and it is a paint sprayed job. Few are ever thrown away and "empties" are sold in antique and gift shops. The same mold in the 1880's produced a milk glass bear with a dark green companion—the milk glass ones now priced up to $35!

The grandaddy of Character bottles, the Poland Spring "Moses," still reproduced, has been employed by others in later years to bottle wine. The three popular characters in clear glass—George Washington, Carrie Nation and Mr. Pickwick, a rage for years as vinegar containers —have been adapted to wine. Another wine merchant uses a bottle today shaped as a bust of George Washing-

ton, a copy of the original Simon's Centennial Bitters.

Sandman's Statuettes, a wine container in black glass, shaped as a Spanish Cavalier and imported from Spain, is a modern "character" of popularity.

"Character" bottles do not pack for shipment as safely or as economically as square-sided, round or flat bottles. They do not "save room" on the retailer's shelf, but they pack human interest and are seldom tossed away. Mary Chess perfumes are all contained in hand polished bottles representing Chessmen.

The real gems came out in the period from 1840-90. No collector has a complete set but a few hobbyists have dug up a pretty good line. Most of the cultured collections, numbering many physicians, have specialized in assembling historical and pictorial flasks—the Masonics, Sunbursts, Eagles, Railroads, Jenny Linds, Washingtons, Franklins and so on, beautiful gems of glass composition and skillful mold making, some valued today at $200. These collectors have disdained the "Characters" which a few of us have specialized in.

I highly treasure the frosted bust of Grover Cleveland, cast as a fancy holiday liquor container in memorialization of a popular president; the small but exquisite bust of Dr. Ward Beecher, the eminent prohibitionist, used to contain whiskey until the family bought them up; the bottle so perfectly shaped as a bunch of asparagus; the lighter shade of amber "Apostle" bottle used for wines; the brandy bottle cast as an elephant, the stopper a bright silver ball on the end of the trunk.

The "Bitters," which might as well have been cast as liquor containers in consideration of their alcoholic content, were ingeniously molded — the Moon Bitters, Brown's Indian Queen, a superb statuette, the Pineapple Bottle Bitters, and the innumerable log cabin designs—Plantations, Holtzerman's Kelly's, a list as long as a Senate debate.

The imported French Wine bottles were not created for any particular brand of wine but were designed as fancy works of glass art for holiday remembrances—quite a few found their way to Western and Canadian bars in the gold rush days.

The frosted Circus Lady standing on her head, her hair flowing over a large sphere, is a gem to behold. The Bather Clinging to a Rock is another beauty. My latest "find" is a French Wine bottle cast as a pipe, stem upward, the bowl resting on a fancy tobacco container.

There are busts of Victor Hugo, General Boulanger, The Czar of Russia, Admiral Dewey, Charlie Chaplin—smaller ones of Dr. Granger, eminent British surgeon, Teddy Roosevelt, exquisite glass bottle statuettes of Joan of Arc burning at the stake, Rebecca at the Well, and of clowns, elephants, owls, baby faces and oddities, such as a dove carrying a bottle on its back, and a bottle shaped as an old sewing basket round out a diversity of designs which inspire thought as to the further opportunity for a resurgence of Character bottle adaptation to the present day.

(Continued on page 290)

CONVECTION CURRENTS IN A GLASS TANK

By IVAN PEYCHÈS, Sc.D.
Director of Research in the Glass Factories of the *Compagnie de Saint-Gobain*

TRANSLATED FROM THE BULLETIN DE L'INSTITUT DU VERRE (PARIS) FOR JUNE, 1947

By LOIS SUTTON and S. R. SCHOLES

PART V

e. *Deductions drawn from models.* At the time of our theoretical research, we have at all times verified our conjectures by models, and, whenever possible, by real tanks. We have already pointed out the interest which, from this point of view, was presented by the furnace of Electroverre Romont, very elongated (25 m x 2 m x 1 m); the movements of transverse convection are comparatively weak and the interpretation difficulties met by Gelhoff[28] in his thick-set furnace (7 m x 5 m) were avoided.

Upon making these studies we have found certain results which would be interesting to note here. We hope that they will be able to suggest certain improvements for furnaces, or contribute to the understanding of certain phenomena.

In that which follows we shall give for each concrete case some figures representing the distribution of speeds and of isotherms in the axis of the tank.

Bare Tank (Plate 1 *a*). In this tank is noticed the curve of speed such as that which is described in figure 29 *b* with the stagnant layer at the bottom. The superficial speed, which appears to be reduced here, is due to the surface tension of the liquid used, which introduces a retarding effect; it does not seem that an analogous effect in the glass exists. The neutral line is well within the anticipated zone. The behavior of the isotherms on the surface will be noticed. This behavior is normal, since, in the unheated portion, it is the glass which heats the crown; therefore it must normally be colder on the surface. The temperature curve passes through a maximum, while its variation is uniform in the heated portion.

The resemblance of the right side of this figure to the photograph 12 will be noted.

Barrier: Simple Routine. Sinking front. Evacuation end (Plate I *b* and *c*). In front of the barrier, the stagnant zone and the sinking front are noticed. The plunging glass can be urged to a speed of the order of several meters per hour. Following Jebsen-Marwedel (21), the ascending speed of a bubble of 1-mm. diameter is, in a bath of 1400°, about 1/3 m/h. Thus, it is entirely possible that such bubbles are found on the other side of the barrier. Behind the barrier a bubbly margin can persist, the finer bubbles rising last. We shall see further on (coupled barriers) that the position of this evacuation end of bubbles in connection with the sinking front of the following barrier can lead to paradoxical results.

Barrier: Dissociated Routines (Plate II *a*).* Here the superficial circulation whose return impinges on the neck current is clearly distinguished. The rising of the neck current after the barrier is very marked. But the most interesting result, and that which we have been able to verify in the actual tank, is that *the isotherm which prevails on the surface after the barrier is the isotherm which prevailed before the barrier at its lower level.*

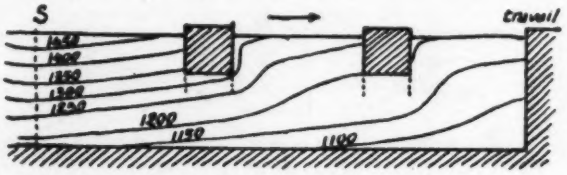


Fig. 32.

The role of a barrier is to suppress the isotherms which press on it from the warm side, and to expand the others in such a way as to make them occupy the whole depth of the tank. This fact permits us to say that the successive barriers have a steadily weakening efficacy as the temperature falls. The effect decreases following a geometric progression. Figure 32 represents this effect schematically.

Separated pair of barriers (Plate II *b*). Two barriers quite far from each other evidently act independently. But as soon as they are drawn together, a zone is established between them which begins to act on its own account and which corresponds to the superficial circulation due to the second barrier. The current of the first throat is hardly raised and it is especially the side stream of the localized current between the two barriers which supplies the superficial portion of the chamber on the working side, when the deep bath is supplied by the current from the first throat.

Neighboring pair of barriers (Plate II *c*). Gradually, as the two barriers approach each other, the side stream of the current between barriers is reabsorbed, the circulation is lessened, and finally a stagnant zone is obtained. The two barriers behave as a simple barrier of great thickness. The temperature routine can be completely modified behind the second barrier and it is possible to demonstrate in this place temperatures which are *higher* than before the placing of the barrier. These phenomena have been actually proven.

At the same time, the position of the second barrier relative to the first may lead to paradoxical observations. The position of the second barrier may be more or less distant according as the second barrier is more or less immersed, that is to say *more or less worn.*

A new barrier can find its current in the evacuation end of the preceding barrier when, once it is worn, its

[28] Gelhoff, *Glastechn. Ber.* 9, 1931, pp. 22-29.

*One notes that the superficial cycle of the dissociated routine seems to be only the exaggeration of the stagnant zone of a simple routine: there must be continuity between the two phenomena. The currents are without doubt too weak to be revealed in the said "stagnant" zone.

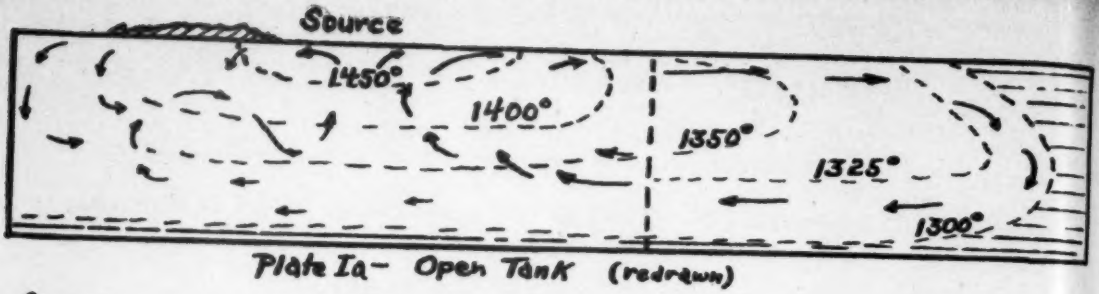


Plate Ia- Open Tank (redrawn)

Plate Ib - Single Barrier (redrawn)

Plate IIb - Double Barrier (redrawn)

Plate IIIb - Bottom Dam (redrawn)

Plate IIIc - Combination Barrier and Dam (redrawn)

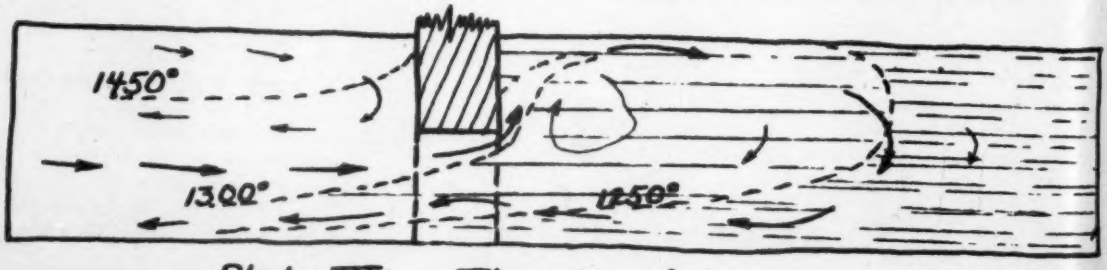


Plate IIIa - Throat (redrawn)

sinking front is separated from this evacuation end. In the first case, the bubbles which have passed under the first barrier are immediately conducted into the working chamber, when, the second barrier being worn, or less deeply immersed, or farther away, it plays its role less effectively. We have personally had the opportunity to observe this curious phenomenon.

Figure 33 shows schematically how the production of multiple routines between coupled barriers can be represented.

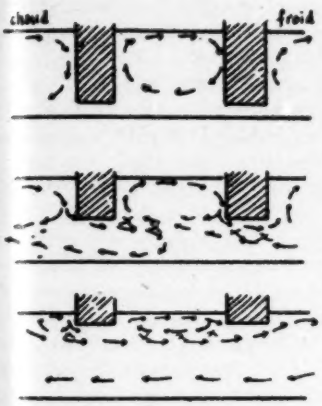


Fig. 33. chaud = hot. froid = cold.

Throat (Plate III *a*). The division of currents in a bridgewall tank is, properly speaking, in the median longitudinal direction, absolutely similar to that which the barrier furnishes; *but here there is always the dissociated routine*. We refer therefore to Plate II for this division.

Seen in plan, the currents diverge from the throat into the working chamber. We have found the spirals of Bowmaker and Cauwood and the rollers of Schild (*loc. cit.*). We refer to these authors for this portion.

Plate III *a* represents the behavior of isotherms following a longitudinal section involving the region of the throat, and following a transverse section right before the throat.

It is noticed that, with a throat of small dimensions, a weak variation, for example the increase of viscosity of the deep glass, can diminish the "effective" height of the throat, from the slackening of the direct wave and the cooling of the working chamber. The viscosity of the return current increasing, the phenomenon can exaggerate itself and lead to the chilling of the throat; it seems that the "frozen necks," which often recur in American literature, spring from the fact that, in the aim of increasing the thermal yield, the builders achieve a routine of instability.

Bottom bench (Plate III *b*). The return current is in no way interrupted by a threshold or bottom bench. This current is raised, crosses the bench and falls heavily on the bottom of the hot compartment. A stagnant zone is retained by the bench.

We have likewise studied the association of a bottom bench and a floating barrier (III *c*). One realizes thus an opening in the "letter box" form taking the glass along an isothermal line. The efficacy seems comparable to that of a throat, but the wave of liquid thus levied is very homogeneous. We have thought that there was a way of applying the short furnace, with a rapid fall of temperature, benefiting the efficacy of the throat, to processes requiring a very homogeneous glass such as drawn glass, etc.

Experiments have plainly justified our expectations.

Conclusions

Whenever a nearly correct theory of thermal exchanges in the tank basin can be established, numerous tentative procedures can be avoided. Actually, some standard dimensions for throats, barriers, etc., have been fixed, thanks to long practice. In the fear, often justified, of going from a medium result to a worse one, one abstains from making great changes.

How many experiments have not been concluded because of too many timid attempts? Any trial in the course of a campaign is penalized by the long transitory routine due to the rearrangement of the convection currents. The natural reaction of a glassmaker is to hold back, and the attempt is considered negative.

Great progress, in a furnace, comes about as a result of innovations introduced during reconstruction, rarely, following small modifications in the course of a campaign. It is therefore necessary to act with a sure step. And the study of movements of glass in the tank basins seems to us to be one of the fundamental essential elements for leading us in the way of progress.

BIBLIOGRAPHY

Theoretical considerations and construction projects for an ideal tank.

"The Cooling of Tank Blocks" by O. Bartsch. *Fachausschussber.* DGG, N8, 23, 1932, pp. 25-26.

"Glass Currents in Tank Furnaces" by F. C. Flint and A. K. Lyle. *Jour. Amer. Cer. Soc.* 15, No. 8, 1932, pp. 410-18.

"The Influence of the construction of a furnace and the conveyance of heat on the glass currents in the tanks". by H. Hausner. *Glastechn. Ber.* 11, 1933, pp. 242-48.

"Some directions for the construction of a throat of a Fourcault tank". by G. Novaky. *Sprechsaal*, 66, 1933, pp. 679 and 697. *Summary Glastechn. Ber.* 12, 1934, p. 65.

"The technical measures of construction assuring the control of glass currents in tanks". by R. Allolio. *Fachausschussber*, DGG, No. 30, 1934, part III.

"On glass currents in melting tanks". by A. Schild. *Z Verein Deut. Ing.* Vol. 78, 1934, pp. 411-14.

"The behavior—good and bad—of glass in tanks". by F. W. Preston. *Bull. Amer. Cer. Soc.*, 1936, No. 12, pp. 409-33.

"Remarks on the question: 'How one obtains a faultless glass in tanks of continuous working' ". by R. Hohlbaum. *Glashutte* 67, 1937, pp. 569-70.

"The homogenization of glass in tanks". by E. Bayer. *Glashutte*, 1937, pp. 691-92.

"The homogeneity of glass" by J. Hurblut. *Glass*, No. 12, December 1938.

"The fusion more or less uniform and less costly of glass, thanks to the control of currents in the tank". (Anonymous) (Account given at the 5th conference of glass of the University of Illinois) *Ceramic Industry*, October 1938, pp. 48-50.

"On the question of currents in the tanks of a glass factory". by W. Schneckloth. *Glastechn. Ber.*, 1939, pp. 99-104.

The study of convection currents after models

"On the suppositions concerning the study of glass currents in model tanks" by J. Runge.

"Glass currents in a tank furnace" by F. C. Flint and A. K. Lyle. *Jour. Amer. Cer. Soc.*, 15, No. 8, 1932, pp. 410-18.

"The study of thermal currents in the tanks after studies with models". by A. Schild. *Glastechn. Ber.* 11, 1933, pp. 305-14.

"Studies with models for the determination of glass currents in tanks and the theory of thermal currents," following a communication of K. Lossen and I. Runge, part III by A. Schild. *Fachausschussber*, DGG, No. 30, 1934.

"The application of models to the study of circulation in tanks of a glass factory". by E. Buckingham. *Jour. Amer. Cer. Soc.*, 20, 1937, No. 1, pp. 1-10.

The direct study of convection currents in operating tanks

A—The use of floaters, ballasted tubes, etc.

"The flow of glass in tanks", part II, by D. McSwiney. *Glass. Ind.* (N.Y.) 8, 1927, pp. 255-58.

By H. Jebsen-Marwedel. *Glastechn. Ber.* 5, 1927, 28, pp. 417-24.

"Movements of glass in drawing tanks" by W. Konig. *Glastechn. Ber.* 5, 1927-28, pp. 417-24.

By O. Stumm. *Glastechn. Ber.* 5, 1927-28, pp. 252-74.

By S. R. Scholes. *Glass Ind.* 9 (*6*), 1928, 126.

"Studies of flow in glass factory tanks of small dimensions" by A. Marden. *J. Soc. Glass Technol.* 15, 1931, pp. 119-28. Summary: *Glastechn. Ber.* 9, 1931, p. 560

"Currents and temperatures in glass factory tanks" by G. Gehlhoff, W. Schneekloth, and M. Thomas. *Glastechn. Ber.* 9, 1931, pp. 22-29.

"The origin and behavior of bubbles and seeds in motionless and moving glass" by H. Jebsen-Marwedel. *Glastechn. Ber.*, 1932, pp. 257-79.

"The influence of glass currents on the refining of glass in a tank". by H. Jebsen-Marwedel. *Fachausschussber* DGG, No. 30, 1934, part I.

"The flow of glass in Fourcault tanks" by J. Callinan. *Glass Ind.* (N.Y.) (N.Y.), 1935, Vol. 16, pp. 239-40, 248. Summary *Glastechn. Ber.* 13, 1935, p. 402.

"On the determination of the quantity of flow in Fourcault tanks" by G. Novaky. *Sprechsaal*, 58, 1935, pp. 228-31. Summary *Glastechn. Ber.* 13, 1935, p. 285.

"The transmission of heat in glass factory tanks" by C. Conc. *Cer. Ind.*, July 1936, pp. 34-42.

"The flow of glass in tanks" by A. L. Marden. *J. Soc. Glass Technol.* 20, December 1936, pp. 676-79.

"Procedure for the study of glass currents in tanks" by W. Schneckloth and W. Spieloogel. *Glastechn. Ber.* 15, 1, 1937, pp. 1-14.

(*Continued on page 289*)

FLAT GLASS ANTI-TRUST SUIT CONTINUES IN TOLEDO

Charging monopolistic practices in the flat glass industry, the Department of Justice continued its anti-trust suit against a group of eight manufacturers and eleven individuals by introducing great quantities of documentary evidence.

Among the phases of alleged monopoly highlighted during the month of April were interests and agreements between American and foreign manufacturers; cross-licensing agreements between domestic manufacturers; and several aspects of domestic trade practices. At one point there developed a colorful account of the unavoidable distress of an isolated manufactory struggling with obsolescent technology. And, during court recess in the week of April 19 deep concern as to the outcome of the trial was reported indicated by the local Federation of Glass, Ceramic & Silica Sand Workers, CIO.

The government put in a large group of documents to show how Pittsburgh Plate Glass Company and St. Gobain, a large French company, formed in 1929 a Dutch company known as N. V. Hollandsche to acquire patents and licenses to manufacture window glass by the process developed by Pittsburgh Plate. The American company held about 25 per cent interest in the Dutch company. Agreement was made not to export glass made by the American process to the United States.

The venture of Libbey-Owens into Europe by way of a Belgian company, known as Compagnie Internationale pour la Fabrication Mecanique du Verre, under a contract signed April 30, 1921 was revealed in a series of documents. Plans were then made for use of Colburn window glass machines in Great Britain, France, Germany, Czechoslovakia, Italy and Spain. A Swiss company also was licensed. Later some of the affiliates got into the manufacture of plate glass.

It was shown by some of the documents that for 25 years plate glass had been controlled as to manufacture and sale under the so-called Convention in Europe but only Pittsburgh Plate-Pilkington and a Libbey-Owens group plus a small Czech company were outside the big group.

In April 1931 a report on the European situation was prepared by Ferdinand Poncelet, managing director of the LOF Belgian affiliate, in Toledo in which he outlined plans for merger of some of the large European companies. Libbey-Owens-Ford held 6.85 per cent voting stock interest in the Belgian company, it was shown.

Other documents showed how the Japanese came to the United States for help in the mechanization and development of their glass industry close upon the end of World War I. As a result of negotiations for several months the America-Japan Sheet Glass Company, at Osaka, was formed to obtain a license for use of the Colburn process perfected by Libbey-Owens Sheet Glass Company, it was brought out. In 1931 the name was changed to Nippon Sheet Glass Company. The government charged that Libbey-Owens-Ford had increased its investments in the company at that time upon securing a promise that the Japanese would not export plate glass to the United States. Previously the company had been only in the window glass business and under its license was not authorized to market its glass in any of the countries where Libbey-Owens-Ford held patents on the Colburn process.

Defense attorneys brought out the fact that Libbey-Owens-Ford owned only a minority interest in the Japanese concern at any time.

One document was a memorandum by J. D. Biggers, president of Libbey-Owens-Ford, after his visit to Japan in 1936, in which he described his favorable impressions of the Japanese glass industry. He stated that Japan had become the leading window glass manufacturer in the world in 1935. Wages were 44 cents a day in the Japanese plants at that time. Mr. Biggers said relations with their affiliate in Japan were favorable but there was no way of knowing what would be the future attitude of other Japanese glass manufacturers.

It was shown that Pittsburgh Plate Glass Company licensed Asahi Glass Co., Ltd., Tokyo, to use its window glass machines in Japan. The agreement, dated July 5, 1930, provided Asahi would not ship its product to the United States and that Pittsburgh Plate in return would not ship to Japan, China, and Manchuria—the natural Japanese market.

It was also shown that Libbey-Owens had licensed Canadian Libbey-Owens Sheet Glass Co., Ltd., Hamilton, Ont., to use two Colburn machines, as of October 12, 1920, and eventually acquired 45.8 per cent of the voting stock. A contract in 1925 was made whereby Canadian Libbey-Owens became sales agency for Belgian window glass by Mecaniver at Moll, Belgium, licensee under the Libbey-Owens Colburn patents. Factory operations in Canada ceased at this time owing to tariff changes.

Formation of Duplate Safety Glass Co., Ltd., Ashawa, Ont., on September 1, 1928 and its licensing to use Pittsburgh Plate processes were also related. Pittsburgh had a third interest in the Canadian company. Pilkington Brothers of England were also interested in Duplate of Canada. It was shown that a license was issued by Libbey-Owens-Ford to Hobbs Manufacturing Co., London, Ont., covering processes for making laminated glass, on September 18, 1936.

Elaborate agreements under which Pittsburgh Plate Glass Company and Libbey-Owens-Ford Glass Company in 1931 cross-licensed each other to use important patents in the safety glass business were read into the records by the plaintiff counsel. The 1931 license agreement granted several non-exclusive licenses between the companies covering patents controlling the use of autoclave, plastics, vertical drawing of thin plate glass, roller lehrs, and also waived all infringement claims and set royalties. Every agreement provided for arbitration of royalties in event agreement was not readily possible, it was brought out by the defense.

Later in 1939 an agreement between the two companies was negotiated whereby royalty payments and infringement claims were eliminated and Libbey-Owens-Ford made a cash payment of $1,375,000 to Pittsburgh Plate.

A list of 784 patents held by Libbey-Owens-Ford and licensed to Pittsburgh was put in evidence. Pleadings indicated that Pittsburgh Plate had approximately the same number of its own patents which it licensed to Libbey-Owens-Ford.

The search for better plastics and plasticizers for safety glass was also emphasized in an agreement made in 1936 whereby costs of development of "Vinylite X" was shared by the two companies.

A sidelight on the keen competitive price situation in plate glass was introduced when plaintiff counsel put in a series of documents dealing with plate glass prices in Canada in 1935. Letters from distributors in Canada to officials of Canadian Libbey-Owens Sheet Glass Co., carried the complaints that jobbers in the United States were shipping glass across the border and underselling the Belgian glass which normally was flowing into Canada. It was pointed out by the defense counsel that American companies at that time had formed the Plate Glass Export Corporation, under the Webb-Pomerene Act, to handle export glass.

How manufacture of tempered glass was started in the United States through the licensing of patents and processes to Pittsburgh Plate and Libbey-Owens-Ford by American Securit Company, formed by St. Gobain, Bussois, and Corning Glass Works, in 1933, was outlined in a series of documents put into evidence by the plaintiff. The license agreements gave the two companies exclusive use so long as they maintained certain royalty payments which were related to prices and profits made on the flat glass tempered under the patented process. Some shop rights were retained for affiliated companies. American Securit also made agreements with Corning, St. Gobain and Bussois companies.

A group of 13 documents which dealt with a license to Ford Motor Company on March 1, 1937 for use of a Colburn window glass machine to supply its own requirements for glass, once rejected by the court, were reoffered by Kenneth R. Lindsay, government counsel, at the conclusion of the patent phase of the case. The court reserved decision.

Defense counsel declared there was no showing in the case at all that the Ford Motor Company "ever desired to enter the glass business as such or to produce any type of glass other than for its own use in connection with the manufacture of motor cars." He said stipulated production schedules showed Ford had been in and out of glass manufacture several times. It was pointed out that Ford also seemed well able to take care of itself, always turning up with important patent rights. Counsel for American Window Glass, which was selling its product to Ford at the time, said the license by Libbey-Owens-Ford of the use of a Colburn machine to Ford, offered "terrific competition" to his client.

Early data on distribution practices, put in by the plaintiff, dealt with formation of the Window Glass Manufacturer's Association and its development of a code of fair trade practices at its Chicago meeting on March 27, 1928. Standardization of quality grading according to government specifications was one of the objectives. Another was the limitation of "C" and Fourth quality glass to approximate market demand. Proper labeling was stressed.

The development of a list of "qualified" buyers on the basis of large volume of glass handled was a continual subject of debate and changes, it was shown in minutes of meetings of WGMA introduced in evidence.

The question of giving a discount to larger buyers was taken up with the U.S. Department of Justice by the glass manufacturers in 1928, it was shown. Qualified buyers were those who had purchased for delivery to warehouse more than 5,000 boxes of glass the preceding year. It was proposed also to give an additional 3 per cent discount on price to buyers who took 10,000 boxes or more per year.

The code as finally adopted was given sanction of the Federal Trade Commission and was in accordance with the ban on price discrimination in the Robinson-Patman Act, it was contended by the defense. It was in effect until the WGMA was disbanded on December 1, 1937.

The struggle of certain antiquated plants to operate with outmoded equipment, against the backdrop of a depression in which the whole industry was operating at 25 to 50 per cent capacity and in which the government was trying to effect codes to stabilize wages and prices, was illuminated by the testimony of William J. Mathews, former vice-president of the Kane-American Plate Glass Co., Kane, Pa.

Mr. Mathews said his company published its price lists usually by copying the terms put out by the larger manufacturers, then under general policy sold at 5 per cent off the list. Mr. Mathews identified a Kane-American price list of February 15, 1934, quoting 34 cents a square foot for factory run glass in the 25-50 foot bracket. Then in May 1934 the price was dropped to 29 cents. By August 1934 the same quality was reduced to 21 cents, according to price lists of defendant companies introduced into evidence.

Invoices showed that discounts of 6 and 7 per cent were used from competitive price lists, and that Kane-American had been selling glass off the list by amounts ranging from 14 per cent on larger sizes to 58 per cent on small glass. The defense brought admissions that glass was being sold that year at prices which had little relation to the published list price.

Mr. Mathews stated that the plant was antiquated and was using processes which had been abandoned 10 or more years before by the large competing companies, that workmen were employed seven days a week and some shifts worked 12 hours a day, that wages were 26½ cents in some jobs, and that the company never did subscribe to the NRA wage and hour plan. He admitted that concessions were made to some jobbers to get money to meet payrolls, that accounts receivable were pledged with local banks to an amount of about $40,000 at one time, and that lack of working capital caused Kane-American to forego discounting bills and pay higher costs for some materials.

He also said the company used certain equipment beyond its economically useful life. He said about $47,000 was used to get the plant in operation and admitted that most of the $21,896 charged to experimental expense was loss in the first few months after putting the plant into operation. The plant had been idle for four years after it was closed by Durant Motors, former owner. It used the obsolete table-casting method.

After the court had recessed for one week starting April 19, it was revealed that Local 9, Federation of Glass, Ceramic & Silica Sand Workers, CIO, represent-

(Continued on page 280)

BORIC OXIDE—ITS CHEMISTRY AND ROLE IN GLASS TECHNOLOGY

By W. A. WEYL
The Pennsylvania State College, State College, Pa.

PART III

V. The Effect of Boric Oxide on Various Properties of Glass

The preceding section was devoted to the structural aspects of boric oxide. It was pointed out that this glass constituent can participate in the glass structure in two fundamentally different ways; namely, in the form of BO_3 triangles and in the form of BO_4 tetrahedra. BO_3 triangles are the constituents of vitreous and crystalline boric oxide. Threefold coordination with oxygen provides a stable and most natural surrounding of the boron ion. Glasses containing these units may be called "solutions" of boric acid, because B_2O_3 affects their properties as expected from the properties of vitreous B_2O_3.

Formation of BO_4 groups produces properties which have no connection with those of the pure B_2O_3. In this case boric oxide makes the glass more "silica-like" and one may call silicate glasses containing BO_4 groups "borosilicates".

The participation of boron in these two forms was discussed in respect to glass composition and temperature. These relations can now be used as a guide for interpreting different properties of glasses containing boric oxide. This section deals with some properties of glasses as affected by boric oxide. It is the purpose of this section to serve as the basis for the following two sections dealing with commercial glasses containing B_2O_3 as a major (Section VI) and as a minor (Section VII) constituent.

1. Surface Tension. It might be considered strange to begin the discussion of a glass constituent with its influence upon surface tension. Indeed, there are very few glass constituents worth mentioning which exert an influence upon this property. Surface tension as a whole is not too well understood, and from the technical point of view little attention has been paid to its manifestations. However, the influence of boric oxide upon the surface tension of fused glasses is so prominent that it is justified to discuss it in some detail.

Boric oxide as a glass constituent is known to influence certain physical properties to an extent which is out of proportion with its concentration. It is claimed, for example, that less than 1% boric oxide gives lustre and sparkle to the glass bottle or tableware. It has been reported that small quantities of boric acid aid fining of the glass melt. It is impossible to explain these effects by the influence which this constituent exerts upon the bulk properties of the glass. The sparkle of a glass is ordinarily associated with its refractive index and its dispersion. It is true that B_2O_3 raises the refractive index of a glass, but so does lime, when substituted for silica. The change of these properties should not be visible to the naked eye because of the minor changes in glass composition involved.

For understanding the reasons why the addition of B_2O_3 to a glass can have a beneficial effect which is out of proportion to its concentration, we must study the influence of this oxide upon surface properties.

Surface tension, usually expressed in dynes/cm, manifests itself in two different ways. First, it is the force which opposes any increase in surface area. Surface tension causes the surface area to approach a minimum (spherical shape). As such it has helped the primitive glass blower in shaping his vase or flask just as it helps today in the manufacture of radio tubes of the most modern design. Watching a full automatic machine turning out complicated glass parts and changing a glass tube into electronic equipment of most intricate shapes, one is surprised to see how much of the operation is left to surface tension and gravity. The role which these forces play in automatic molding of glass and the laws governing these shaping operations have been described by G. Jaeckel (1934). Less understood is the role which surface forces play in the homogenizing and fining of glass. In several papers H. Jebsen-Marwedel described startling phenomena concerning the diffusion and disappearance of cords as a function of the surface tension of the glasses involved. Even if the surface forces and the interfacial tension is not yet completely understood, their importance for the homogeneity of the glass have been corroborated by W. B. Silverman (1942). Shartsis and Smock (1947) correlate seed quality and surface tension values for a number of optical glasses. They found significant relations between the surface tension, pot attack and seed quality. Even if the phenomena involved depend on several variables, the fact remains that a growing gas bubble has to do work against the surface tension of the liquid.

The second manifestation of surface tension is not less important. It deals with molecular rearrangements in the surface layer of the liquid. Recently the author in his paper "Some Practical Aspects of the Surface Chemistry of Glass" gave a detailed description of the chemical changes to be expected in a glass surface. In order to decrease the surface-free energy, those glass forming units which decrease the external electrical or chemical forces accumulate in the surface layer. It is well known that the weak alkali ions have a tendency to migrate into the surface layer of a glass and will do so on annealing. If unchecked, the surface alkalinity of a soda-lime-glass increases with the time of annealing. The probability of finding a certain ion in the surface layer depends more on its electric field strength than on its concentration in the glass melt. Small ions with high charge, such as Si^{4} ordinarily will not be found in the surface area. Their strong forces demand the formation of SiO^{4} complexes, and a freshly broken glass surface will therefore attract instantaneously moisture or a layer of gas molecules. On first thought one would expect boron to behave like sili-

con because its electric field strength is of the same order of magnitude. Looking at the structure of boric acid, however, we see that the valence forces of boron can be active in a plane with a minimum of attraction perpendicular to this plane (See III 3).

In spite of its high ionic potential, boron can decrease the surface free energy of a glass by migrating into the surface layer and forming BO_3 triangles oriented parallel to the surface.

Compared with the other glass forming oxides, B_2O_3 has a very low, even a negative, factor of surface tension. According to K. C. Lyon, who calculated the factors of surface tension for the major glass constituents, B_2O_3 has the value of 0.23 (at 1200°C.) as compared with 3.25 for silica or 5.98 for alumina. This value is of the same order as that of the alkali oxides and may even assume a negative value at higher temperatures (1400°C.).

Boric oxide lowers the surface tension of a glass because it participates in the structure of the surface in the form of planar BO_3 triangles with a boron ion in the center, thus exerting strong forces in the direction of the plane but weak forces perpendicular to it. The characteristic feature of B_2O_3 is therefore dependent on two conditions: formation of BO_3 triangles rather than BO_4 tetrahedra and orientation of the planar BO_3 groups parallel to the glass surface.

In the discussion of the participation of boron in the structure of silicate glasses (See IV 4) we learned that the addition of small amounts of B_2O_3 produces BO_4 tetrahedra which interlink with the SiO_4 tetrahedra. Only if the silicate glass does not contain sufficient alkali or if the amount of B_2O_3 exceeds a certain value between 10 and 20% will the boron participate in its natural triangular coordination. This property of B_2O_3 which was made responsible for the "boric acid anomaly" is limited, however, to the bulk of the glass and is not observed in its surface. In the surface layer boron exists only in triangular coordination and as a result the "boric acid anomaly" does not exist for the surface tension. In contrast to all other properties the surface tension of an alkali-lime-silica glass is affected by the substitution of B_2O_3 for SiO_2 in exactly the same direction as one would expect from the property of pure B_2O_3 glass. Boric oxide has a low surface tension and increasing additions of B_2O_3 to a silicate glass lowers its surface tension without producing an extreme value. This can be seen from Table VII. which gives surface tension values of a series of fused soda-lime borosilicates according to G. Keppeler (1937).

TABLE VII.

Glass No.	1	2	3	4	5	6
SiO_2	76.0	74.4	72.9	70.9	68.4	65.9
B_2O_3	—	1.5	3.0	5.0	7.5	10.0
R_2O_3		constant		1.4		
CaO		constant		8.9		
Na_2O		constant		13.8		
Surface Tension dynes/cm	321.3	310.9	301.8	301.1	288.5	277.8

The orientation of the BO_3 triangles parallel to the glass surface, the second condition for boric oxide lowering the surface tension of glasses, decreases with increased thermal motion. As a rule the surface tension of glasses, fused salts or liquids in general decreases with increasing temperature. According to W. A. Weyl (1947) this relation does not exist for those glass melts whose surface tension is strongly affected by the presence of asymmetrical ionic groups. C. A. Bradley (1938) reported that the surface tension of fused boric oxide as measured by the sessile drop method increased with increasing temperatures as can be seen from his values.

300°C.	57.0	dynes/cm
400°C.	62.1	" "
500°C.	66.9	" "

Recently Shartsis and Smock (1947) measured the surface tension of boric oxide over a temperature range from 700°C. to 1400°C. and found a steady increase with temperatures. Their values which were obtained by the "maximum pull-on-cylinder" method extrapolated to lower temperatures agree very well with those of Bradley. According to Shartsis and Smock the surface tension of vitreous and fused boric oxide as a function of the absolute temperature T can be expressed by the term $47.6 + 0.0354\ T$ dynes/cm.

A positive temperature coefficient of surface tension can be observed also for glasses containing other "asymmetrical units", especially lead ions. If two types of asymmetrical units are present, the surface tension—composition relation becomes rather complicated, as can be seen from molten lead borates, where both planar BO_3 units and asymmetrical Pb^{2+} can be expected in the surface film. Independent measurements of the surface tension of lead borates by S. Carlen (1947) and L. Shartsis, S. Spinner and A. W. Smock (1948) reveal that their temperatures coefficients change signs as a function of composition and that for certain B_2O_3-PbO ratios the temperature coefficient of surface tension can become zero.

Because of the interesting features this work of Shartsis, Spinner and Smock shall be discussed in more detail. Table VIII. gives their values for 900°C.

In the composition region of 0-40% PbO the surface tension is almost constant. As has been pointed out previously (See III 5) this region is characterized by an immiscibility gap at low temperature. At 900°C., however, only one liquid phase exists. The authors interpret their observations as follows:

> "This condition may indicate that the composition of the surface layer is quite different from that of the interior of the liquid and that since the surface tension differs but little from that of pure B_2O_3, that this layer consists almost wholly of that oxide."

This conclusion is strongly supported by the fact that over this whole region the temperature coefficient of surface tension has a positive value. As pointed out previously this means that increased thermal motion interferes with the orientation of the BO_3 triangles which tends to be parallel to the surface.

As the concentration of PbO increases, some of the BO_3 triangles change into fourfold coordination which means: increased symmetry. The probability of finding BO_3 triangles in the surface decreases and the surface tension values rise rather sharply as the PbO content increases from 40 to 80%. At 84% PbO the surface tension has reached a maximum and further increase of PbO causes this value to drop to that of PbO.

The temperature coefficient of surface tension of the

(*Continued on page* 284)

CHECK ON PRESIDENT'S TARIFF POWERS URGED IN TRADE ACT EXTENSION

As June 12, the date when the Trade Agreements Act either must be extended or allowed to expire, approaches, Congressmen are feeling pressure from three sides. One group, the extreme free traders, is pushing for a three-year extension of the law as it now stands. High tariff exponents, on the other hand, favor letting the measure die—and would like to see it well buried.

Between these extremes is a group of businessmen, representing varied interests, who suggest that a new act be framed that will dilute the sweeping power now held by the President and the State Department to negotiate the reciprocal agreements and set their terms. These businessmen feel that past agreements have been written with too much regard for international politics and too little regard for United States business.

The situation is now confused because the International Trade Organization Charter, which has been under discussion at Havana by delegates of over 50 nations for the past three months, has not yet been completed and presented to Congress for its consideration and action. The charter, expected to present a pattern for world trade developed by a large portion of the business world, will presumably provide Congress with a guide to intelligent action on our own Trade Agreements Act. A new act can then be framed that will be consistent with whatever action Congress may take on the ITO Charter.

The delay at Havana makes it probable that Congress will not receive the ITO charter in time for action at this session. Yet, it is believed, Congress cannot, for poltical reasons, defer action on the Trade Agreements Act. To let the act expire might raise a new election issue that both parties would rather avoid. Informed opinion therefore inclines to the belief that Congress will sidestep by voting a one-year extension.

If such a compromise course is followed, support is expected for amendments that will protect the country during the extension period from what many regard as abuses of the power the act confers on the Executive. Both parties could thus be assured, it is said, that in voting such an amended measure no advantage would be created for either opponents or proponents of reciprocal agreements.

The "safeguard" amendment would require the Tariff Commission to give the State Department a ruling on all matters of tariff change. State would then have to negotiate changes in rates and regulations within the limits laid down by the Tariff Commission. Basic virtue of the amendment, its backers argue, is that it returns to the legislative branch the control of revenue legislation and thus conforms to the doctrine of checks and balances. The Tariff Commission is answerable directly to Congress. Its importance has been progressively dwarfed since the inauguration of the trade agreements program, the State Department having taken over much of the work and authority over tariffs.

Strong impetus to the effort to revise the act was given by the latest batch of agreements negotiated, which granted deep cuts in import duties on an extensive list of commodities that are produced in this country. The glass manufacturing industry has a vital interest in the matter of tariffs and it may be said that the very existence of certain segments of the industry depend on equal opportunity in a competitive market.

Dr. H. Maurach and Dr. W. E. S. Turner

FRANKFORT BECOMES CENTER OF GERMAN GLASS TECHNOLOGY

Dr. W. E. S. Turner, leading British glass technologist and chairman of the International Glass Commission, visited Frankfort, Germany, in December. The visit was greatly appreciated in Germany and interpreted as the first step towards the resumption of scientific relations of British, French and American with German glass technologists after a long period of complete separation.

Dr. H. Maurach, acting chairman of the Huettentechnische Vereiningung and the Glastechnische Gesellschaft, in his negotiations with Dr. Turner, discussed the German work of recent years and stressed the desire for renewed international collaboration. It is believed that such collaboration will be realized soon.

The Glastechnische Berichte will reappear in the near future in Frankfort. At the same time, the Glass Department of the "Economic Administration," Minden, and the "Association of Glass Manufacturers" moved to Frankfort. This city has thus become the economic and technological center of the glass industry in the western zones of occupation.

D. G. HOOD TO SUPERVISE DIAMOND'S GLASS INDUSTRY SALES

Diamond Alkali Company has announced the appointment of D. G. Hood to supervise the company's Glass Industry Sales.

Mr. Hood, who has been connected with the company for 20 years, has come to his present position after successive promotions and was made assistant to the late George H. Dahlin when Mr. Dahlin was in charge of Glass Industry Sales. More recently he held the same position under J. C. McKenna, whose appointment as Manager of Chronium Chemical Sales was also announced.

A graduate of Pennsylvania State College, Mr. Hood's responsibilities will include sales supervision to the glass industry of a substantial part of the company's output of soda ash.

INVENTIONS AND INVENTORS

A Summary of Recently Issued Patents of Interest to the Glass Industry

Feeding and Forming

Device for Removing Bottles from Molds. Fig. 1. Patent No. 2,438,088. This is the invention of Alphons Wyss of Bottmingen, Switzerland, where a similar patent application has been filed. The general idea of the patent is to provide means for taking bottles or other glassware from the blow mold and placing it on a conveyor by which it is carried to the lehr. It is stated that in prior machines, hand work was required because the ware went out of shape after being removed from the molds. This invention provides a split mold and several bottom plates cooperating with the mold. The bottom plates cooperate with the mold while the bottle is being blown and then carry the bottle away while it is cooling.

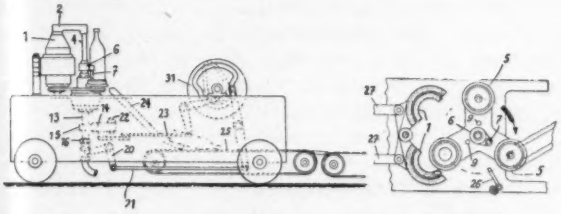


Fig. 1. Device for Removing Bottles from Molds.

Fig. 1 is a side view of a well known type of single mold machine in which the parison is lowered vertically to the blow molds. The two halves of the finishing mold 1 are opened and closed as usual by rods 27 shown in the lower part of the figure. Three bottom plates 5 are mounted on a shaft 13 and they are arranged for vertical adjustment. A blow head 2 provides means for blowing the bottle in the mold.

In the operation of this device, after blowing the bottle in the usual manner, the arbor 13 is lifted slightly which lifts the blow bell 2 out of contact with the mold 1. The rods 27 then open the mold 1, leaving the bottle on one of the bottom plates 5. The arbor 13 is then turned to take away the finished bottle on its bottom plate 5. The same movement brings another bottom plate 5 into position to receive a new parison in the blow mold. After a bottle has cooled sufficiently, it is moved onto a conveyor by a thrust-bar 26 which delivers it to a chute 24 by which it goes to a conveyor 25.

The patent shows no references cited by the Patent Office.

Tube Drawing Machine. Fig. 2. Patent No. 2,438,448. This is the invention of William A. Morton and Theodore H. Sloan who assigned it to G. M. S. Corporation of Pittsburgh, Pa. Glass tubing and cane is generally made by a machine such as shown in Patent No. 1,218,598 to Danner. This invention provides an apparatus for receiving the tube from the forming machine and cutting it into the desired lengths. A device of this kind is shown in the Danner Patent No. 1,220,201 but that machine had numerous objectionable features which are not present in this invention.

At the right of the figure is shown a tractor stand 10, a second stand 11 and a tractor and scoring stand 12

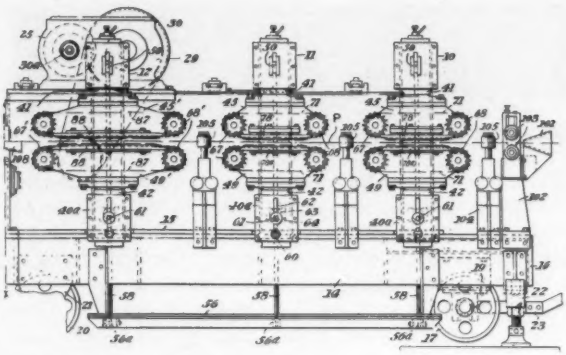


Fig. 2. Tube Drawing Machine.

from which the work is delivered to a carry-away conveyor. The whole business is mounted on wheels such as 17 and 20 so that it can be moved from one forming machine to another. Jacks 22 are provided so that the wheels may be lifted when the apparatus is to be held in fixed position.

A motor 25 acts through a variable-speed drive 29 to actuate the tractor stands of which the stand 10 is an example. This stand has guide block carrying mechanism 41 and 42 which engages the tube traveling along the line P. The arrangement is such that the tube may be driven with various angles of skew relative to the line of travel.

The stand 12 is provided with scoring units carried by chains 87. Tubing is started through a guide 101 at the right of the figure. It then passes through guide rolls 103 and 105 to chains carried by the stand 10 and then to the other stands. When the tubing reaches the stand 12 it is severed into the desired lengths. These are carried away by mechanism at the left of the figure (not shown).

The following references are of record in the file of this patent: United States Patents: 786,565, Hughes, Apr. 4, 1905; 876,267, Colburn, Jan. 7, 1908; 1,136,362, Pease, Apr. 20, 1915; 1,220,201, Danner, Mar. 27, 1917; 1,578,098, Schrader, Mar. 23, 1926; 1,580,809, Brown, Apr. 13, 1926; 1,595,103, Kingsley, Aug. 10, 1926; 1,660,323, Brown, Feb. 28, 1928; 1,743,960, Favre, Jan. 14, 1930; 1,776,556, Gray et al., Sept. 23, 1930; 1,876,031, Soubier, Sept. 6, 1932; 1,887,414, Le Roy, Nov. 8, 1932; 1,951,993, Pond, Mar. 20, 1934; 2,009,326, Sanchez-Vello, July 23, 1935; 2,009,793, Sanchez-Vella, July 30, 1935; 2,085,904, Freese, July 6, 1937; 2,091,494, Snyder, Aug. 31, 1937; 2,120,853, Brown et al., June 14, 1938; 2,155,131, Hanlein, Apr. 18, 1939; 2,157,067, Brown et al., May 2, 1939; 2,234,302, Dichter, Mar. 11, 1941; 2,243,937, Almond, June 3, 1941; 2,290,837, Stuckert, July 21, 1942; and 2,303,587, Snyder, Dec. 1, 1942. Foreign Patents: 480,621, Germany, Aug. 5, 1929; 540,414, Germany, Dec. 17, 1931; 543,172, Great Britain, Feb. 12, 1942; and 774,191, France, Sept. 17, 1934.

Glass Compositions

Eastman Kodak Silicoborate Glass. Patent No. 2,439,-

Fig. 3. Ceramic Glaze Composition.

192. This glass is the invention of Kuan-Han Sun and Thomas E. Callear who assigned the patent to Eastman Kodak Company. It is particularly useful as a base glass for making colored glass filters. The glass melts at a low temperature (about 1050°C.) which makes it possible to make the melts in high silica glass crucibles, thus avoiding contamination of the glass by the material of the crucible.

In its simplest form, this glass consists of the oxides or beryllium, aluminum, silicon, boron and an alkali (lithium, sodium or potassium) of which lithium is preferred. The following table gives seven examples of this simple form of the glass, the weight being designated W and cationic per cent by C.

	$LiO_{0.5}$		BeO		$AlO_{1.5}$		SiO_2		$BO_{1.5}$	
Example	W	C	W	C	W	C	W	C	W	C
1	17.0	34	11.7	14	6.8	4	20.1	10	44.4	38
2	18.3	36	10.2	12	3.5	2	20.5	10	47.5	40
3	17.7	36	9.9	12	3.4	2	27.7	14	41.3	36
4	14.9	32	9.3	12	3.2	6	33.6	14	39.0	36
5	15.0	32	9.4	12	9.6	2	26.5	18	39.5	36
6	15.2	32	9.6	12	16.2	10	19.1	10	39.9	36
7	14.1	30	9.4	12	6.4	4	26.4	14	43.7	40
Limits Weight per cent	8-18		3-16		25-23		10-34		21-45	
Limits Cationic per cent	27-38		3-18		2-10		10-18		30-40	

The patent gives several tables of compositions having other materials added to the base glass as given above.

In making any of these glasses, the batch materials are thoroughly mixed in dry powdered form and fed into a platinum vessel inside a furnace. If the batch contains lead oxide, a vessel of high silica glass is recommended. The batch melts to a clear liquid at about 1050°C. or less. The time required for the melt depends, of course, on the materials in the batch and the composition. The glass is then poured into a mold previously heated to about 350-550°C., and slowly cooled to room temperature. A colorless glass is produced which is highly resistant to moisture.

The following references are of record in the file of this patent: United States Patents: 1,964,321, Hood, June 26, 1934. Foreign Patents: 477,698, Great Britain, 1938.

Miscellaneous Processes

Ceramic Glaze Composition. Fig. 3. Patent No. 2,438,524. This composition was invented by Forrest L. Turbett and Harry B. Stephenson, Jr., of Joplin, Mo., who assigned it to The Eagle-Pitcher Company of Cincinnati, Ohio. The glaze produced shows a very low solubility which has not been found before in lead containing glazes.

The method of producing this raw material consists in using constituents within the range of about:

	Per cent by weight
PbO	65.01 to 61.35
SiO_2	34.89 to 26.41
Al_2O_3	0.10 to 12.24

A furnace charge is made within the above range of proportions, the PbO having fine particle size; for example, 2.0 microns median radius. The silica (glass sand) is ground to —300 mesh, and the alumina (kaolin $H_4Al_2Si_2O_9$, which corresponds to SiO_2 46.5%, Al_2O_3 39.5% and H_2O 14%) the same firmness. It is to be noted that these substances are extremely fine. They are conveniently prepared by separate ball milling, although any suitable method of preparation may be used.

The three components are mixed thoroughly before heating, preferably while dry. A satisfactory mixture is made by rotating in a ball mill at 50 R.P.M. for 4 hours. The charge is then placed in a gas-fired reverberatory or electric furnace and heated to incipient fusion in an oxidizing or neutral atmosphere at from 1230° to 1400°F. (650°C. to 760°C.). The time of heating should approximate 2 to 4 hours, and should be continued until a color change from a characteristic straw color to light yellow occurs.

Professor Clark, who is well known in this art, has prepared two X-ray diffraction patterns shown in Fig. 3. The upper part of the figure shows the distinct rings due to definite crystal structure in the incipiently fused product while the lower part shows the pattern of the corresponding product made by complete fusion which gives the appearance characteristic of glass.

The resulting glaze is exceptionally pure and quite an advance in the art. The only reference cited in the Patent Office was Dana's Manual of Mineralogy (Ford 13th ed.), page 281.

Corhart Cast Refractory. Patent No. 2,438,552. This is the invention of Theodore E. Field of Louisville, Ky., who assigned it to Corhart Refractories Company. Patent No. 2,271,366 by the same inventor pointed out that such refractories consisting of zirconia and corundum crystals in a matrix of uncrystallized glass were especially resistant to corrosion by molten glass. However, it was found impossible to make this material on a commercial basis, free from cracks.

The inventor has now found that cracking can be prevented by altering the chemical composition and therefore the physical properties of the glass phase alone. Six examples of compositions which have produced blocks highly resistant to glass attack and free from cracks are given in the following table:

Melt	ZrO_2	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	MgO	K_2O	Na_2O
V	21.4	11.04	63.0	1.30	1.55	.46	.27	.28	.69
W	20.4	10.30	63.9	1.63	1.95	.48	.28	.05	1.04
X	19.9	10.25	65.4	1.20	1.69	.18	.10	.13	1.18
Y	20.1	10.09	65.3	1.00	1.80	.17	.07	.08	1.40
Z	40.0	11.07	45.9	.43	.72	.14	.02	.08	1.65
A—A.	40.0	11.04	45.3	.60	.72	.14	.02	.08	2.13

The following references are of record in the file of this patent: United States Patents: 1,615,751, Fulcher, Jan. 25, 1927; 1,682,251, Riddle, Aug. 28, 1928; 2,271,366, Field, Jan. 27, 1942; and 2,271,367, Fulcher et al., Jan. 27, 1942. Foreign Patents: 800,779, France, 1936.

Machine for Molding Beads on Wire. Fig. 4. Patent No. 2,439,437. John S. Stull of Chicago, Ill., made this invention and assigned it to Western Electric Company of New York. The machine is made particularly for the purpose of molding glass beads on the output leads of electronic tubes. It is well known that the alignment between the glass bead and the lead must be as nearly perfect as possible for the best results. This machine produces much more accurate results than has been possible by earlier methods. (*Continued on page* 286)

Research Digest

Clay Crucibles for High-Density Glasses, Glazes and Enamels

In the March 1948 issue of the *Technical News Bulletin* of the National Bureau of Standards, a description is given of the properties and method of manufacture of special clay crucibles which have resulted from two recent developments of the Bureau's refractories laboratory. One of these, a new composition for the body of the crucible, gives an improved structure. The other, an additional step in the procedure for lining crucibles, aids in sealing invisible, incipient cracks in the lining. The usual clay crucible is quite porous and therefore subject to penetration and attack by highly corrosive melts. By contrast, the pores in the new crucible are very small, and the interconnecting passages between them so minute that they effectively resist the flow of molten fluids.

The manufacture of high-quality glass calls for pots or crucibles that will resist attack from the molten glass and that will not introduce impurities through interaction with the glass. To meet the exacting requirements peculiar to the production of optical glass, the refractories laboratory has for over 20 years been engaged in research on refractory clay pots, techniques for their manufacture, and special compositions for particular applications. All of the pots used by the Bureau's optical glass plant, during capacity operation in both wars and pilot operations in other years, have been manufactured by the refractories laboratory. In fact, observations of the performance of pots in the plant have afforded an exceptional opportunity for the study and correction of defects in pot structure, and have led to improvements in the quality of the glass.

For most glasses that have been produced, two types of pots have generally been satisfactory. One of these, containing a dense low-porosity lining, has been used for manufacture of the more corrosive glasses, the other without a lining for those less corrosive. Several unique procedures developed at the Bureau are followed in the manufacture of these pots. The technique of slip-casting, first reported nearly 30 years ago, is used exclusively in preference to hand-molding methods. In this method the clay casting slip, that is, the mixture of dry ingredients with the proper amounts of deflocculants and water to give a good pouring consistency, is poured into plaster-of-paris molds. The molds consist of two parts, a shell and a core that is locked in position before the pot is cast. During the initial stage of casting, the mold is slightly tilted to lessen the tendency to entrap air bubbles between the lining and the pot. After the bottom is filled, the mold is brought level and rocked lightly until the pot is completely cast. Rocking serves the dual purpose of leveling the slip as it is cast and of freeing the air trapped in the slip during the casting operation.

Lining of the pots is in effect applied before the pots are cast. In other words, the lining slip is first poured around the core of the mold, which is removed and transferred to the shell. The pot is then cast in the same manner as for unlined pots. Double and triple layers of lining, up to a total thickness of ¼ inch or more, are sometimes applied.

The additional step that has recently been introduced in the procedure for lining crucibles consists in spraying a coat or coats of clay slip over the lining to seal incipient cracks. Although not visible in the dry state, these cracks often open during use and permit a fluid glass or glaze to penetrate into the walls or in some instances leak entirely through the crucible.

The cores are removed as soon as practicable after casting in order to prevent cracking of the lining—timing of this operation is critical—and the shells are removed when the pots have set sufficiently to retain their shape. The pots are then air-dried and, finally, immediately before use, are heated to approximately the temperature of the melt they are to contain. A carefully regulated heating schedule must be followed in this step, with the rise in temperature controlled in accordance with the relative speed with which the pot can be heated without damage through certain ranges.

The new crucible composition, originally developed for highly corrosive glasses, possesses several desirable properties in addition to its unusual pore structure. It has low gas permeability, even though it shows a porosity of 22 per cent after firing at 1,435° C. Crucibles of this composition have somewhat lower resistance to thermal shock, but considerably greater resistance to corrosion.

TABLE I

Composition of Refractory Clay Crucibles for Highly Corrosive Glasses, Glazes, and Enamels

Material	Amount Per Cent
North Carolina kaolin	11
Georgia kaolin	9
Tennessee No. 5 ball clay	10
Kentucky No. 4 ball clay	10
Grog (reclaimed shell from used pots):	
Passing No. 10, retained on No. 20	13.1
Passing No. 20, retained on No. 40	9.7
Passing No. 40, retained on No. 100	13.8
Passing No. 100	23.4
Silicate of soda*	.025
Sodium carbonate*	.012

*Deflocculants, added as solutions. To 100 lb. of dry batch are added 57 ml of a 10-per cent solution of sodium carbonate, 115 ml of silicate of soda (Philadelphia Quartz Co. "S" brand or equivalent) and 2.56 gallons of water.

Multicellular Glass

While at the present time multicellular glass is only used for certain specific purposes, it may have applications in other fields. The following summary, which has been taken directly from the abstract section of the October-December, 1947, issue of *The Journal of the Society of Glass Technology*, is given to acquaint the glass technologist with the basic principles of its manufacture.

"The fundamental principle of all the methods for the manufacture of multicellular glasses consisted of a dispersion of gases or vapors in a glass melt while in a plastic state. The dispersion could take place according to different processes: (i) By the evolution of melting-reaction gases contained or dissolved in the fluid or hardening glass melt; (ii) by stirring in, immersing or compressing

(*Continued on page* 282)

PERSONNEL CHANGES AT IMPERIAL GLASS

C. W. Gustkey, President of Imperial Glass Corporation, has announced several personnel changes in the company. George W. Boyd has been appointed Secretary-Treasurer and has been elected a member of the Board of Directors and Executive Committee of that company. Mr. Boyd has been with the company since 1931 in credit, purchasing and accounting positions.

J. Thomas Ball has been appointed Plant Manager and will also serve as a member of the Executive Committee. From 1919 until 1940, Mr. Ball was employed by the Central Glass Works in Wheeling as Secretary-Treasurer. Since joining Imperial Glass Corporation, he has served as salesman, sales supervisor and in production management and supervision.

H. Carl Gustkey has been elected Vice President. Since joining the firm early in 1945, he has been doing personnel work and has been a member of the Board of Directors. He continues as a Board Member and, with Mr. Boyd and Mr. Ball, assumes new responsibilities as a member of the Executive Committee. He had formerly been associated with the State Road Commission of West Virginia,, General Motors Acceptance Corporation and the Federal Bureau of Investigations.

The Executive Committee of Imperial Glass Corporation now consists of C. W. Gustkey, President; C. J. Uhrmann, Vice President and General Manager; H. Earl Gustkey, Vice President; J. Thomas Ball, Plant Manager; and George W. Boyd, Secretary-Treasurer.

Officers and Directors of Imperial are now J. W. Stewart, Chairman of the Board; C. W. Gustkey, President; C. J. Uhrmann, Vice President and General Manager; H. Earl Gustkey, Vice President; George W. Boyd, Secretary-Treasurer; K. C. Cooper, Corporation Counsel; John McConnell; W. M. Allen, Carl Koch; J. E. Green and Joseph Flaherty.

BAUSCH & LOMB BUILDS UNDERGROUND LABORATORY

A recent report made by the Bausch & Lomb Optical Company has announced the building of an underground laboratory which, it is stated, will be vibration-proof and is designed to control temperatures to within one hundredth of a degree. Upon completion of the project, the laboratory will house engines used to rule diffraction gratings.

Designed by John J. Esterheld and Michael M. Serron, Bausch & Lomb architects, the laboratory is being built on solid rock, 10¾ feet below ground level. More than 175 tons of concrete and six tons of reinforcing steel will be used in constructing the building which is 30 feet long, 16 feet wide and nine feet high on the inside.

Side walls, made of layers of four-inch brick, waterproofing, insulating material and 14-inch steel reinforced concrete, will be 21 inches thick. The roof, designed to support a 250-ton covering of earth which will provide the required insulation, will be 18 inches thick. Interior walls and ceilings will be sealed to prevent vaporization.

The extreme precision required in ruling diffraction gratings with diamond tools explains the laboratory's unusual construction specifications. Gratings, used in spectrographs in place of the usual quartz or glass prisms, are small optical surfaces ruled with 15,000 or more straight parallel lines per inch.

REPORT ON JAPANESE OPTICAL GLASS MANUFACTURE

A report of the U. S. Naval Technical Mission to Japan has been released by the Office of Technical Services, Department of Commerce, concerning the growth of Japanese optical glass manufacture during the war. Although no spectacular scientific developments occurred, the report states that Japanese technicians successfully adapted and modified optical systems and instruments used in Germany and the United States.

Pots of one ton capacity are usually employed, although the Fuji Optical Company has more recently used pots of two ton capacity. Manually controlled gas-heated furnaces equipped with thermocouples and recording instruments are used. In some cases, the pots are preheated in separate furnaces; in others, they are preheated in the melting oven before charging. Charging of the pots is accomplished manually with a scoop and requires considerable time. The finished glass is cooled in the pots and later molded into blanks by placing the pieces in refractory containers. Small size lenses are pressed into rough shape in the usual manner.

The Japanese copy the constants of the optical systems used in Germany and the instruments used in the United States. Their main problem in the war was to vary the curvatures and separations and, in some cases, to increase the number of elements in particular types of lens systems. The Japanese exhibited a tendency toward large size aperture optical instruments particularly for binocular telescopes. The development may have been due to an attempt to offset deficiencies in radar, the report suggests.

Standard methods of grinding and polishing are used. Lenses are finished on "heads" and prisms on "fences". The coating of glass surfaces is accomplished either by a chemical method of treating the glass with nitric acid, or by an evaporation method in which cryolite is evaporated and deposited on the surface in vacuum followed by baking for one hour.

The report describes these practices in considerable detail and includes many tables giving data on production and specifications for optical products. Twelve photos of the Fuji Optical Company plant are included. Mimeographed copies of the 58-page report (PB-85162, *Japanese optics*) may be obtained for $1.50. Orders should be addressed to the Office of Technical Services, Department of Commerce, Washington 25, D. C. and should be accompanied by check or money order payable to the Treasurer of the United States.

PERSONNEL CHANGES AT PENNSALT

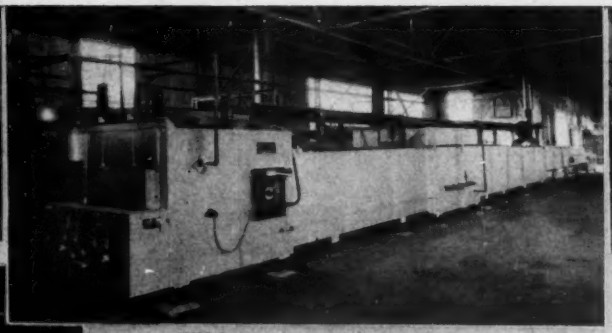
Five new personnel appointments in the Research and Development Department have been announced by Pennsylvania Salt Manufacturing Company.

J. Philip Evans has been named Assistant Manager of the Department and has been associated with the company since 1942. Before his new appointment, Mr. Evans had been Senior Electrical Engineer in the company's Central Engineering Division.

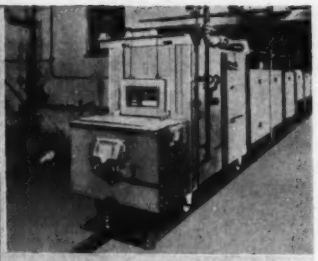
The other new additions include Clifton R. Neumoyer, Senior Research Chemist in the Research Division; Harold L. Warner, Associate Patent Attorney, Patent Division; Joseph Simkin, Research Chemist, Special Products Division; and Charles A. P. von Hemert, Junior Chemical Engineer, Development Division.

A Lehr For Every Purpose . . .

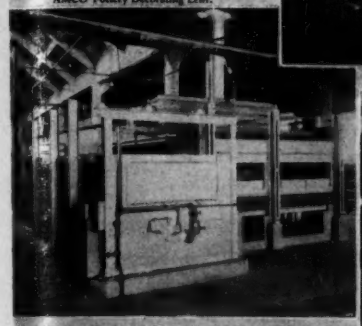
AMCO Pottery Decorating Lehr.



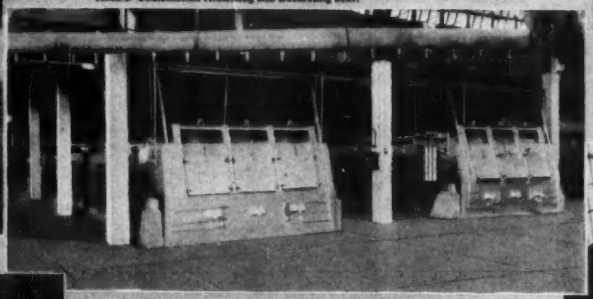
AMCO Combination Annealing and Decorating Lehr.



AMCO Miniature Lehr.



AMCO Combination Mechanical Bending Oven and Lehr for Large and Small Glass Discs.



2 — 10 ft. x 80 ft. AMCO L W. Lehrs for Annealing Illuminating Ware.

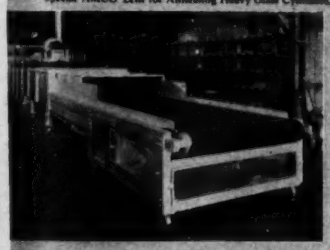
8-AMCO Lehrs in one Glass Factory.

6 ft. x 400 ft. Continuous Sheet Glass Lehr.

Special AMCO Lehr for Annealing Heavy Glass Cylinders.

AMCO L W. Lehr for Oven Ware, etc. — Built in 6 ft., 8 ft., and 10 ft. widths.

AMCO Bottle Annealing Lehr.



Heavy AMCO Lehrs designed especially for annealing Milk Bottles.

One of many AMCO Annealing Lehrs built in Europe.

AMCO Glass Decorating Lehr.

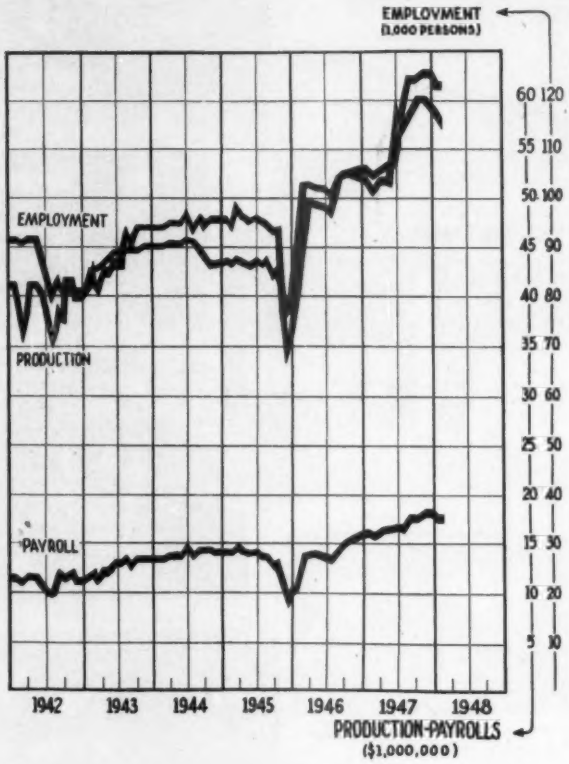
AMCO Bulb Lehr—Speed up to 30 ft. per minute.

AMSLER MORTON
CORPORATION

Chamber of Commerce Bldg., Pittsburgh 19, Pennsylvania

CURRENT STATISTICAL POSITION OF GLASS

THE GLASS INDUSTRY'S INDEX



Activity in the glass industry for the month of February 1948, as shown in the Production Index, remained the same as for January—an estimated $61,700,000. Activity during February 1947 was about $54,500,000, or about 13 per cent below February this year. Total output for the first two months of 1948 is an estimated $123,400,000, as compared with $111,500,000 during the corresponding period in 1947.

Employment and payrolls: The number of persons employed in the glass industry during the month of February 1948 decreased close to 4 per cent from 119,700 employed during January to 115,000 during February.

Payrolls for February 1948 remained the same as for January, which was an approximate $17,500,000. Payrolls during February 1947 were $15,500,000, which is about 12 per cent below February 1948. During the first two months of 1948, glass manufacturers have paid out an estimated total of $35,000,000. During the same period in 1947, payrolls were an estimated $31,500,000, or about 11 per cent below 1948.

Glass container production for March 1948, based on figures released by the Bureau of Census, after declining steadily for the past several months, jumped 20 per cent from the 7,335,393 gross produced during February to 8,851,340 gross. During March 1947, production had been 10,640,482 gross, which is close to 14 per cent above the March figure for this year. Total glass container production thus far in 1948 is 24,242,575 gross, as compared with 31,064,620 gross during this period in 1947. This indicates a decrease of close to 22 per cent from last year for the first quarter of 1948.

Shipments for March 1948 jumped sharply to become the second largest glass container shipment figure for a single month. Shipments for March were 10,526,959 gross. The all-time high, which was during August 1946, was 10,650,866 gross. Shipments during February 1948 were 7,197,491 gross, or 46 per cent below March. The March 1947 shipment figure was 10,012,450 gross, which is about 5 per cent below March this year. Total ship-

(*Continued on page* 274)

GLASS CONTAINER PRODUCTION AND INVENTORY

(All figures in gross)

		Production March 1948	*Stocks March 1948*
Foods; Medicinal & Health Supplies; Chemicals, Household, Industrials, Toiletries and Cosmetics	Narrow Neck	3,012,989	2,280,971
	Wide Mouth	*2,611,358	1,655,253
Dairy Products		259,355	269,605
Home Canning		106,820	826,295
Beverages, Returnable		1,083,921	594,042
Beverages, Non-returnable		.....	.....
Beer, Returnable		590,608	544,124
Beer, Non-returnable		210,727	193,057
Liquors		659,499	301,309
Wines		316,063	152,258
Packers' Tumblers		.....	52,062
Total		8,851,340	6,868,976

*This figure includes "Packers' Tumblers."

GLASS CONTAINER SHIPMENTS

(All figures in gross)

Narrow Neck Containers	*March 1948*
Foods	971,471
Medicinal & Health Supplies	1,273,634
Chemical, Household & Industrials	669,922
Beverages, Returnable	1,336,884
Beverages, Non-returnable	.....
Beer, Returnable	715,918
Beer, Non-returnable	245,530
Liquors	644,974
Wines	367,920
Toiletries & Cosmetics	603,424
Sub-Total (Narrow)	6,829,677
Wide Mouth Containers	
Foods	2,307,406
Dairy Products	261,343
Home Canning	88,062
Medicinal & Health Supplies	304,999
Chemical, Household & Industrials	113,245
Toiletries & Cosmetics	140,064
Packers' Tumblers	126,427
Sub-Total (Wide)	3,341,546
Total Domestic	10,171,223
Export Shipments	355,736
Total Shipments	10,526,959

Announcing

KROMECAST

A NEW CHROME-BASE, HIGH-STRENGTH 3100 F REFRACTORY CASTABLE

B&W KROMECAST...another original development by B&W . . . combines important advantages never before available in chrome-base castables or plastics.

B&W KROMECAST...in addition to supplying chemical resistance at high temperatures to attack by molten slags, mill scale, and other reactive products:

possesses the ability to support loads at elevated temperatures *and can be used in vertical walls and many types of roof arches without support.*

has unusual volume stability at temperatures as high as 3100 F.

can be poured like ordinary concrete, plastered in place, or applied with a cement gun.

B&W KROMECAST means less time spent in building and repairing furnaces. It means longer continuous operating periods. It means lower overall production costs. It opens the way for many new applications that were impossible with previously available chrome-base plastics or castables.

SUGGESTED APPLICATIONS

HEARTHS

FURNACE WALLS

FLOORS

CAR TOPS

DOOR AND FRAME LININGS

ELECTRIC FURNACE ROOFS

FORMING SPECIAL SHAPES

PATCHING

For complete information on this new, unique chrome-base refractory castable, write for Bulletin R-26—or call your local B&W Refractories Engineer.

R-315

B&W REFRACTORIES PRODUCTS

B&W 80 FIREBRICK • B&W JUNIOR FIREBRICK
B&W 80 GLASS TANK BLOCKS • B&W INSULATING FIREBRICK
B&W REFRACTORY CASTABLES, PLASTICS AND MORTARS

•

OTHER B&W PRODUCTS

Stationary & Marine Boilers and Component Equipment
Chemical Recovery Units . . . Seamless & Welded Tubes . . . Pulverizers
Fuel Burning Equipment . . . Pressure Vessels . . . Alloy Castings

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
REFRACTORIES DIVISION
GENERAL OFFICES: 85 LIBERTY ST., NEW YORK 6, N.Y.
WORKS: AUGUSTA, GA.

TO HELP YOU KEEP PRODUCTION UP COSTS DOWN

use WALSH glass house Refractories

More efficient and economical service throughout a longer life is the typical record of WALSH REFRACTORIES for the Glass Industry. That's why more and more Glass Tank Operators are specifying money-saving WALSH products:

CAST-FLUX, Vacuum Cast Tank Blocks

C.S.R., Cast Sillaminite Refractory

REFRACTORY Upper Structure Grade

POT FURNACE REFRACTORIES

MULLITEX "RB", MULLITEX, WARCO XX and WARCO grades of Fire Clay Brick

MULLITEX and MORT-AIRSET, High Temperature Cements

To get maximum service life for your refractory dollars, insist on WALSH-made products. For details apply at once to

WALSH REFRACTORIES CORPORATION
ST. LOUIS MISSOURI U.S.A.

FOR OVER 50 YEARS MANUFACTURERS OF HIGH GRADE REFRACTORIES

CURRENT STATISTICS . . .

(*Continued from page* 272)

ments for the first quarter of 1948 are 25,141,957 gross, or 14 per cent below the 29,523,249 gross shipped during this period in 1947.

Stocks on hand for March 1948 are the lowest on record since June 1947. The March figure is 6,868,976 gross. Stocks at the close of February 1948 were 8,511,015 gross and at the close of March 1947, 5,140,116 gross.

Plate glass production, according to the Hughes Statistical Bureau, broke all records for an all-time high of 23,572,257 sq. ft. The previous high was during October 1946 when plate glass production reached 23,270,656 sq. ft. The March figure represents an increase of 8 per cent over the previous month's 21,751,195 sq. ft. and an increase of 3 per cent over March 1947's 22,605,264 sq. ft. Total plate glass production for the first three months of 1948 has reached a total of 67,281,013 sq. ft., as compared with 64,852,415 sq. ft. in the corresponding period in 1947. This is a difference of about 3 per cent.

Automatic tumbler production for March 1948 was 5,222,513 dozens. This represents an increase of close to 21 per cent over the 4,325,496 dozens produced during February 1948. Production during March 1947 was 6,272,261 dozens. Shipments for March 1948 rose close to 24 per cent to a figure of 5,313,986 dozens. The February figure was 4,295,901 dozens. Shipments during March 1947 were 5,974,554 dozens. Stocks on hand at the close of March 1948 were 8,659,354 dozens; at the close of February 1948, 8,741,301 dozens; and at the close of March 1947, 5,575,294 dozens.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware increased about 36 per cent for March 1948. The March figure was 4,146,736 dozens, as compared with 3,051,054 dozens for February 1948. Sales during March 1947 were 3,213,252 dozens. Total manufacturers' sales for the 12-month period ending March 1948 are 42,378,571 dozens. At the close of the same period in 1947, sales had reached a total of 45,076,360 dozens.

MATHIESON ALKALI WORKS CHANGES NAME

Stockholders of The Mathieson Alkali Works at the annual meeting approved a change in the company's name to Mathieson Chemical Corporation. The change from the original name, adopted when the company was formed in 1892, is for the purpose of identifying the company with its increasingly diversified line of products. The new name will become effective as soon as registration formalities have been completed.

At the same meeting, authorized common stock of the corporation was increased from 1,000,000 to 1,500,000 shares. The new stock, together with previously unissued and Treasury stock, will make available approximately 672,000 common shares which may be used for additional financing.

Check Chart of TECO GLASS PLANT SERVICES

Service No. 1 **GLASS MELTING TANKS** — Designed and built. Fired by gas or oil or built with quick change-over equipment to use either fuel as desired or necessary.

Service No. 2 **ANNEALING AND DECORATING LEHRS** — Embodying efficient FIROLL Burners, anti-friction bearings, heat resisting alloy steel and other new features that assure delivery of large output economically.

Service No. 3 **BOTTLE STACKERS** — For use with TECO or other lehrs. Handle bottles of various sizes and shapes up to 2 quart capacity automatically. Variable in capacity to conform to lehr speed.

Service No. 4 **HYDROSTATIC BREAK TYPE BOTTLE TESTERS** — Fast, accurate, safe. For various shapes and sizes of containers.

Service No. 5 **DUAL FUEL FIRING EQUIPMENT** — Designed and installed on existing equipment.

Service No. 6 **SAND DAMPERS** — For producer gas lines. Tight sand seal without metal to metal contact. 36 to 96 inch diameters.

Service No. 7 **REPAIRS AND REMODELING** — For modernization of existing glass plants.

Service No. 8 **CONSULTING SERVICE** — For elimination of production problems and modernization of methods.

Service No. 9 **COMPLETE GLASS PLANTS** — Designed and built with all machinery installed in position.

For information regarding any service use the convenient coupon.

FILL IN — CUT OUT AND MAIL

Toledo Engineering Co. Date.....
Toledo, Ohio

Send us information regarding the services we have checked:
(1) (2) (3) (4) (5)
(6) (7) (8) (9)

Name.....
Company.....
Address.....
City.....State.....

TOLEDO ENGINEERING Company
GLASS MELTING and MANUFACTURING EQUIPMENT
EASTERN OFFICES 330 E. LEXINGTON ST. BALTIMORE MD. . . . 958 Wall St. TOLEDO, O.

AUTOMATIC LP-GAS-AIR SYSTEM SOLVES FUEL SHORTAGE

Faced with a shortage of Michigan natural gas until completion of the Michigan-Wisconsin pipeline early in 1950, the western districts of Michigan Consolidated Gas Company were compelled not only to begin manufacture of all the oil-gas possible in the Grand Rapids and Muskegon districts, but also to discontinue service to 12 large industrial users, according to R. L. McKinstry, of the Michigan Consolidated Gas Co.

The industrial customers were given the option of finding their own means of substitute fuel or accepting the installation of liquefied petroleum (LP) gas equipment furnished by the gas company. Industry was to furnish its own supply of LP-Gas. Three of the industries accepted the gas company's offer and the installations of storage tanks and appurtenances were made during the summer and fall of 1947.

The basic requirement for the LP-Gas and air mixture is that it be interchangeable in heating value to the natural gas formerly used, so that no changes are required in burner adjustments. Once set up for a given LP-Gas, such as propane, little adjustment of the automatic control system is needed. Requirements for the gas mixture in the area varied from about 35,000 to 80,000 cubic feet per hour at peak load in given plants.

Brown Instrument Company engineers, called upon to recommend an automatic system for mixing the LP-Gas with air at a constant ratio, supplied the installation, thereby enabling production to continue uninterrupted. The system utilizes standard mechanical differential-pressure type meters equipped with Air-o-Line pneumatic control, which operate North American adjustable port valves in the gas and air lines at the plant central mixing station. Installed about four months ago, the control systems have performed with only occasional routine checking under plant load conditions varying from 3 per cent to 100 per cent of capacity.

The basic operating principle of the ratio control system is that equal and fixed pressure differentials are separately maintained across the gas and air valves. Variations in plant demand are accommodated by the openings of the control valves. With constant differential pressures, flows through the gas and air valves are proportional to the respective valve openings. Such a variable orifice arrangement permits a much greater turndown range than could be obtained with the use of fixed orifices and a conventional ratio flow control system.

Auxiliary equipment includes an LPG vaporizer heated by steam to provide the LP-Gas, a pressure regulator on the gas line to maintain a constant pressure upstream from the gas valve (5 psi, in one instance), and a check valve on the air line to prevent back flow of gas in the air line, when the air compressor is shut down. Small dial type, indicating pressure gauges are installed on the downstream side of the control valves to provide a check on the pressure and also an indication for emergency hand control.

Utilizing standard control equipment, the ratio control system provides a simple, easily adjustable method of automatically mixing LP-Gas and air with the following advantages: 1) High accuracy of controlled ratio from maximum to almost zero demand; 2) Exact adjustment of ratio, yet easily changed by external knobs on the valve bodies for different LP-Gases (such as from propane to butane or to a mixture of the two); and 3) Incorporates Air-o-Line proportional pneumatic control with automatic reset to accommodate load changes.

G.C.M.I. APPOINTS BENJAMIN WOOD AS MARKETING DIRECTOR

Robert L. Warren, President of the Glass Container Manufacturers Institute, has announced the appointment of Benjamin Wood as Director of Marketing for the Institute. Mr. Wood has been Managing Director of Tea Bureau, Inc., for the past ten years. Mr. Wood has presented the recently appointed marketing groups retained by the Institute.

Prior to his association with the Tea Bureau, Mr. Wood has been identified for many years with the advertising business in the mail order field. He is probably best known in research circles as the originator of the Cleveland Press "Pantry Shelf Survey", a basic research technique which has been used by more than twenty newspapers on a continuing basis.

N.Y. METROPOLITAN A.C.S. SECTION MAY MEETING

At the May meeting of the New York Metropolitan Section of the American Ceramic Society to be held on May 19, Dr. B. S. Ellefson, Director of Central Research Laboratories of Sylvania Electric Products, Inc., will discuss "Ceramic Developments in the Electronic Field".

On the same program, Mr. A. J. Monack, Consulting Engineer, is scheduled to discuss "The Chemistry of Glass-Metal Seals".

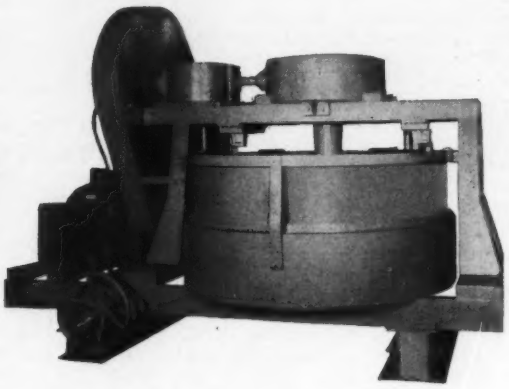
HEWITT RUBBER DEVELOPS HOT MATERIALS CONVEYOR BELT

The development of a hot materials conveyor belt that is cushioned with rubber and strengthened with glass has been announced by the Hewitt Rubber Division of Hewitt-Robins, Inc. At the same time, Hewitt engineers revealed a glass-fiber rubber hose that, it is stated, resists any kind of acid and gives much longer service than standard cotton yarn reinforced hose.

In the use of the new hot materials conveyor belting, the company has found it will not char or lose strength from heat under 350°F., nor will it lose strength at the fasteners by heat burning out around bolts. It will not stretch for there is very little elongation in fiberglas fabric. According to the announcement, the plies are as strong as steel of equal weight.

In one foundry, a Hewitt Maltese Cross Fiberglas belt was installed in March 1946 and was taken off more than six months later. It was found the only wear or damage was where the belt had been ripped by the conveyor skirtboard. This belt was used in the foundry shakeout carrying red hot foundry sand. The average temperature of the sand was 400°F. The Fiberglas belt, it is stated, gave two and one-half times longer service than a previous belt of cotton and asbestos.

Increased PRODUCTION PRECISION PROFIT



"Lancaster's" New No. 4½ Heavy Duty . . . High Capacity . . . High Precision Mixer.

with the Scientific "LANCASTER" Mixer

The "Lancaster" Mixer has become "preferred equipment" in leading glass plants. Reason? 3 of the most important are:

1. Increased Production. On installation after installation, the "Lancaster" has increased production because (a) the rapid, *complete* mixing provided by "Lancaster's" exclusive combination of counter-current mixing with balanced mulling results in higher output per hour . . . per man . . . per machine; (b) rapid charging, discharging and cleaning cuts time between batches; (c) dependably uniform mixing, batch after batch, promotes higher production efficiency.

Material is conveyed by clockwise rotation of mixing pan and deflected by stationary sidewall and bottom plows into path of mixing tools rotating counter-clockwise off-center of pan diameter.

2. Increased Precision. The "Lancaster" Mixer is built for heavy duty, high capacity service. For more than a decade, the glass and ceramic industry has recognized "Lancaster" as the *precision* mixer. The "Lancaster" brings acknowledged machine-tool precision to the mixing art.

3. Increased Profits. Because of this combination of increased production with increased precision, the "Lancaster" Mixer broadens profit opportunities. In addition to the man-hours saved, costs are further reduced by (a) dependable batch control which saves valuable ingredients, (b) minimized materials handling, (c) elimination of adjustment and corrections caused by faulty batch preparation.

Details about "Lancaster's" 7 unit sizes and 27 models are furnished without obligation. Write today for free bulletins. No obligation.

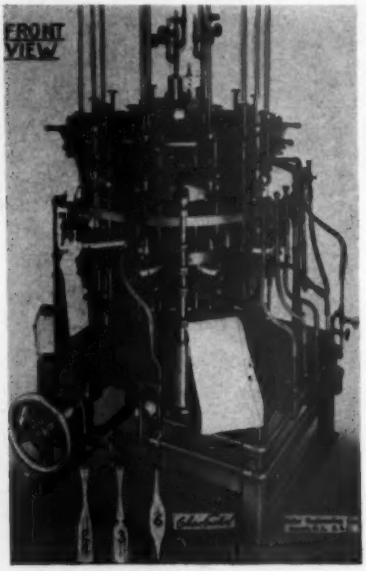
LANCASTER IRON WORKS, INC.
BRICK MACHINERY DIVISION
LANCASTER, PENNA., U. S. A.

NEW EQUIPMENT AND SUPPLIES

EISLER HIGH SPEED AMPULE MAKING MACHINE

Eisler Engineering Company, Newark 3, New Jersey, has announced an improved 10-head ampule machine capable of making three different standard types of ampules from glass tubing with approximately 35 per cent greater output than any previous construction of a similar kind.

The complete assembly is mounted on a steel fabricated table structure and powered by a ½ HP electric motor, 1725 rpm. with variable speed drive. The turret and the chucks rotate continuously around the stationary center shaft of the machine; the chucks are also kept revolving on their own axes, driven by separate gearing. The machine is fully automatic and the job of the operator consists only in feeding the glass tube in its full length of approximately 5 feet into the chucks.



As the turret rotates, the glass tube in its first two positions is preheated, passing thereafter three sets of special burners of different flame-shape and fire-intensity which in subsequent operations of drawing, constricting and bottoming automatically perform the desired forming of the ampule.

On reaching the last position, the finished ampule is automatically cut from the glass by a cut-off burner and discharged into the chute. Before the new cycle starts, the tube holding chuck is automatically opened and the released glass moves downward under its own weight to be immediately clamped again in the new automatically closing chuck. The operating steps repeat in the same manner until the glass is all used up. A shock-absorbing abutment-plate checks resiliently the drop of the tube to prevent spoilage.

The machine can handle glass tubes with outside diameter ranging either from 8 to 20mm or 12 to 22mm and can be adjusted for making ampules in all standard heights. Approximate production of the machine per hour is 700 to 1500, depending on the size, type and glass material of the tube.

AUTOMATIC CENTER PUNCH FOR GLASS

Vinco Products, 326 Bond Street, Asbury Park, New Jersey, has announced production of a new automatic center punch for glass and hardened steels having a tip of Carboloy cemented carbide.

The new Model C-20 permits the routine marking of materials on which ordinary steel punches would become dull almost immediately, according to the announcement. The marker is 4 inches long, weighs 1½ ounces and contains a spring-actuated hammer tripped by pressure on the punch. Pressure of the spring may be adjusted to anywhere between 8 and 20 pounds by means of an adjusting screw. At the lowest pressure setting, a "shock absorber" action permits adjusting the blow so that the glass and light gauge metals can be center punched for subsequent operations without shattering or distorting them.

FORCED CONVECTION ELECTRIC OVENS

Modern Electric Laboratory, 6131 S. Wentworth Avenue, Chicago, Illinois, has announced production of a new, modern, completely functional forced convection electric utility oven.

The ovens are made in both floor and bench models and in six standard sizes. Two series are available, one series of six having a maximum temperature of 350°F, the other series in the same sizes provides a maximum temperature of 550°F, 110/120 volts or 220/240 volts, 50/60 cycles.

The ovens are integrally constructed, being welded throughout. A specially designed multi-bladed turbo-blower circulates preheated air at the desired temperature to every part of the oven. The blower is powered by a heavy-duty ball-bearing motor especially designed for blower operation. Heater element is a special alloy wire arranged to thoroughly preheat incoming air before it is circulated in the oven.

The action of the blower combined with special air vents produced 50 air changes a minute. According to the company's report, this rapid movement of heated air assures faster, more uniform heating of samples. Precise heat control is accomplished by means of a super-sensitive (½°C) hydraulic snap action thermostat.

IMPROVED COMBUSTION SAFEGUARD

Wheelco Instruments Company, 847 W. Harrison Street, Chicago 7, Illinois, has developed two new improvements for use with the Wheelco Flame-otrol to provide increased safety and equipment protection against explosion hazards. The Flame-otrol is a combustion safeguard for gas and oil fired furnaces, ovens, boilers, kilns and other heating equipment.

A "Safe Start Relay" is mounted on the chassis of the instrument to prevent operation in the event that any unsafe condition exists during start up period. Even depressing the push-button of the manual reset will not put the system in operation until a safe condition is assured.

The Wheelco Flame-eye, sensing unit for oil-fired equipment, is now equipped with a "Blue Sensitive" photo cell which is responsive only to "blue spectral" rays which are a characteristic of oil flames. This new feature eliminates detrimental effects of red rays reflected from furnace walls or other extraneous sources.

CATALOGUES RECEIVED

Hartford-Empire Company, Hartford 1, Conn., has issued three bulletins: "HE Comparators," "Unavoidable Profits come from better use of better glass" and "Hartford-Empire Double Dead Plate Conveyor."

The first booklet illustrates and describes the various types of comparators and gages produced by Hartford-Empire and explains their operation.

The second booklet, "Unavoidable Profits . . ." is a resume of the services given by the Glass Technology Division of the company. The services include formulation of batches, research on special materials, introduction of operating and control methods, recommendation of glass compositions, testing raw materials, glass, finished ware, training laboratory personnel, special investigations, testing new ideas before commercial use, complete laboratory design and engineering. Each phase of these services is discussed in the booklet.

The third booklet features the double dead plate conveyor with a line drawing of a conveyor operation. The operation of the conveyor is discussed and various features listed.

Pulverizing Machinery Company, 120 Chatham Road, Summit, New Jersey, has announced a new illustrated bulletin, "Optimum Recovery with the Mikro-Collector."

The features of the new Mikro-Collector for dust collecting are described in detail in text and illustration and special emphasis is placed on the ability of the equipment to handle damp and hitherto baffling dust loads. Filter rates, dimensions, weights and other details are fully covered in the bulletin.

Published information has indicated that fluorine compounds offer certain desirable characteristics to manufacturers of flat glass and glass containers:

1 Increased durability[a] when present in proper amounts.

2 A remarkable viscosity control[b]—a little goes a long way.

3 Appreciably increased melting speed.

4 Better fining action.

5 Improved color—because of the complexing action of fluorine with iron.

[a] *"Effects of Fluorine and Phosphorus Pentoxide on Properties of Soda Dolomite Lime-Silica Glass", Journal of American Ceramic Society, December, 1944—pages 369-372.*

[b] *"Container Glass Compositions—1932-1946" H. Moore and A. K. Lyle, The Glass Industry, November, 1947—pages 563-566, 588, 590, 592.*

Kryolith contains fluorine in addition to soda and alumina, small amounts of which are generally needed in glass manufacture. Kryolith is a *natural* cryolite flux.

Featuring:

- Minimum Fume Nuisance
- Stability . . . remains stable at fusion point (1000°C)
- Uniformity and Purity

Pennsalt maintains ample reserve stock piles of cryolite ore. In addition, adequate refining capacity and strategically located warehouse stocks of finished Kryolith assure you a steady supply of this superior flux.

Kryolith's features have helped others get smoother operation and better finished products. Next time you formulate, try Kryolith . . . the *natural* cryolite flux.

Pennsylvania Salt Manufacturing Co., 1000 Widener Building, Phila. 7, Pa.

PENN SALT
Chemicals

FLAT GLASS ANTI TRUST SUIT CONTINUES IN TOLEDO . . .

(*Continued from page* 263)

ing nearly 4,000 workmen in Libbey-Owens-Ford plants in the Toledo area, had received a reply to its letter to Attorney General Tom Clark asking several questions about relations of the employees to the antitrust suit and especially the divestitute relief being asked by the Antitrust Division.

William Akos, local union president, said a reply had been received from John Ford Baecher, first assistant in the Antitrust Division, advising the union that it might file a brief as "friend of the court" in preference to becoming an actual party to the suit, if it wanted to put the views of its members on record.

Mr. Akos told the attorney general of the "deep concern of the union" over the suit and especially the demand of the government that all plants except one each owned by Libbey-Owens-Ford, Pittsburgh Plate and American Window Glass Co., be sold to independent owners. He said the union is worried about dismemberment from the standpoint of preservation of individual seniority rights, guarantee of employment here, the union contract itself, and what would happen to accumulated employee benefits and interplant rights.

The union president said the suit may affect 4,000 families in Toledo and up to 20,000 families in other flat glass cities. He said more than 35 per cent of the union employees had worked at more than one of the Libbey-Owens-Ford plants.

Mr. Baecher said the purpose of the suit is remedial and not punitive. He said, "The government itself will also remain cognizant of your interests."

Plaintiff expects to conclude its presentation between May 7 and 15. Defense will be put over until autumn, after the usual summer vacation.

CANADIAN HEALTH REGULATION INCREASES GLASSWARE SALES

Following the creation of new health regulations in the Ottawa area of Canada compelling all restaurants and eating establishments to replace their glassware if cracked in any way, business in such articles has been greatly increased and sales records increased on account of the sudden demand for glassware.

The health authorities are watching all restaurants and eating places to see that they replace all cracked glassware to comply with the new laws and this is causing a "rush" of business for such supplies, especially since slowness of deliveries is reported in many cases.

HOMMEL APPOINTS SALES ENGINEER

The O. Hommel Company has recently announced the appointment of Roy D. Beck as sales engineer of the Midwest area. Mr. Beck first entered the ceramic industry after his graduation from Ohio State University.

Since that time, his 22 years experience in this field included work in laboratory control, plant layout, production management, professional engineering and sales throughout the United States. Prior to joining Hommel, he was head of the Domestic Finish Appliance Division of the Pressed Steel Car Company.

SYMPOSIUM ON WIND TUNNEL OPTICS SPONSORED BY BUREAU OF STANDARDS

The first symposium on Wind-Tunnel Optics—a new field concerned with wind-tunnel instrumentation, especially for supersonic velocities—was sponsored recently by the National Bureau of Standards under the technical direction of Dr. I. C. Gardner of the Bureau's Optical Instruments Section and C. H. Hahner of the Bureau's Glass Section.

For many years, wind-tunnel measurements were limited chiefly to pressures and forces produced by air moving about objects. With the relatively recent advent of high speeds, reaching and even greatly exceeding that of sound, it has become possible to observe the flow field by optical methods. This not only makes the wind tunnel a more versatile research tool but, in particular, makes possible the observation of important phenomena associated with compressibility, which occurs at speeds now regularly achieved by projectiles, rockets and by some of the jet propelled planes that have been developed or are now in the drawing boards.

The flow of air around a solid object is accompanied by changes in pressures and this in turn gives rise to variations in the index of refraction of the air. This variation of index may be made visible by interferometric or schlieren apparatus. The design, construction and use of this type of apparatus are embraced by the recently coined term, "Wind-tunnel optics." This is really a branch of optical engineering in which well-established principles of optics are applied as tools in an entirely distinct art. It distinguishes itself from other branches of engineering in that equipment is required of a different order of size from interferometric and schlieren apparatus constructed for the longer established practices. This in turn makes interesting demands on the glass maker.

The construction of large glass discs of quality became a neglected art several decades ago when reflecting telescopes supplanted refractors. Now, however, discs 36 inches in diameter are often required and even larger constructions have been contemplated. Bureau staff members from the glass laboratory and the optical instruments laboratory discussed problems connected with the production of large windows and discs of interferometer or schlieren quality, both by casting and by other methods. Of particular importance is the elimination of optical heterogeneities by reduction of temperature gradients in annealing. Techniques for the measurement of strain and for testing the planeness and parallelism of surfaces were also described.

Although the optical principles back of wind-tunnel optics are well established, their applications to this relatively new field call for specialized techniques and interpretations. Schlieren methods, interpretation of results and interferometer measurements and production of fringes with heterochromatic light were among the topics of this nature discussed.

TEICHMANN COMPANY MOVES OFFICES

Henry F. Teichmann, Inc., formerly located in the Pitt Bank Building, has moved to new offices in the Investment Building, 237 Fourth Avenue, Pittsburgh, Pa.

Incorporated in November 1947, the firm offers engineering, consulting and contracting services to the glass and ceramic industries.

NORTH AMERICAN

ATMOSPHERIC REGULATORS

● Series 18 North American Atmospheric Regulators are designed especially for single valve control of premix gas burner systems and incorporate the new feature of a soft seat for tight shutoff when the demand for gas flow ceases. Users will find the tight shutoff feature quite advantageous in that close control can be realized at low gas flow.

● Single valve control can be used with non-premix systems by connecting the vent on the Series 18 Atmospheric Regulator to the air line downstream from the control valve. The regulator responds quickly to very slight changes in impulse line pressure.

● When the Series 18 Atmospheric Regulator is used, both premix and non-premix systems are assured proportional air-gas ratios over the entire capacity range of the regulator.

THE NORTH AMERICAN MANUFACTURING COMPANY
GAS or OIL COMBUSTION EQUIPMENT ● OFFICES in PRINCIPAL CITIES
CLEVELAND 5, OHIO

RESEARCH DIGEST . . .

(*Continued from page* 269)

of gases or vapors into fluid glass melts of a certain viscosity; (iii) by thermal, or otherwise promoted, gaseous reactions of inorganic and organic substances which were either (*a*) added to the batch mixtures, or (*b*) stirred into the melt, or (iv) added to a glass powder dispersoid.

"The problem of the manufacture of multicellular glasses was to introduce into the melt the longest persisting gaseous nuclei for the most favorable evolution of bubbles and to prevent the escape of the liberated gases. By method (ii) the problem was most difficult; the gaseous nuclei had first to be dispersed in the fluid glass, after which the evolution of gas bubbles took place. Investigations on the disappearance of bubbles in glass according to the composition of their content seemed to indicate a possible reversible reaction between gaseous nuclei substance and glass melt. This would also be influenced by the chemical composition of the glass. Hence, for the further development of these products, there resulted the inevitable necessity of adjusting the chemical composition of the glass on the one hand to that of the gas bubbles on the other hand so that there would be no possibility of reaction between them.

"The substances which yielded gaseous nuclei were tabulated and classified according to their method of operation and included carbonates, which functioned by thermal decomposition; certain oxides which gave rise to ebullition as a result of reduction, vaporization, higher oxidation or decomposition; nitrates as oxidizing agents; sulphates, by reduction and decomposition; carboniferous compounds as reducing agents and as combustible substances; certain metals, such as Al, Zn, Sn, by vaporization; gases and vapors, such as H_2O, CO_2, SO_2, SO_3, CO, O_2, N_2, air and other mixtures producing the desired result mainly by thermal expansion or by reduction, oxidation or decomposition."

A.C.S. SECTION MEETINGS

As a climax to the 1947-48 season, the Pittsburgh Section of the American Ceramic Society will hold its annual Ladies Night on May 21 with a gala dinner-dance.

Guest speaker at the April meeting of the Trenton Section of the Society was Harry Van Horn of the Socony-Vacuum Oil fellowship at Rutgers University whose subject was "Organic Materials Used in Ceramic Manufacture". He outlined the organic compounds used and discussed some of the experiments they are doing.

The April meeting of the Pittsburgh Section featured an address by Dr. George O. G. Lof, Technical Director of the Denver plant of the Colorado Fuel and Iron Company and consultant for the American Window Glass Company. His subject was "The Utilization of Solar Heat".

Officers for the Pittsburgh Section were elected for the coming year. Those elected were F. L. Bishop, American Window Glass Company, Chairman; D. O. Evans, Corning Glass Works, Vice-Chairman; F. P. Shonkwiler, Harbison-Walker Refractories Company, Secretary; W. C. Mohr, Westinghouse Electric Company, Treasurer; and Theodore Lenchner, Vitro Manufacturing Company, Councillor.

BORAX

When included as a minor constituent in the container batch formula will justify its addition in improvements in the melting, fining, and forming operations as well as impart beneficial properties to the finished container.

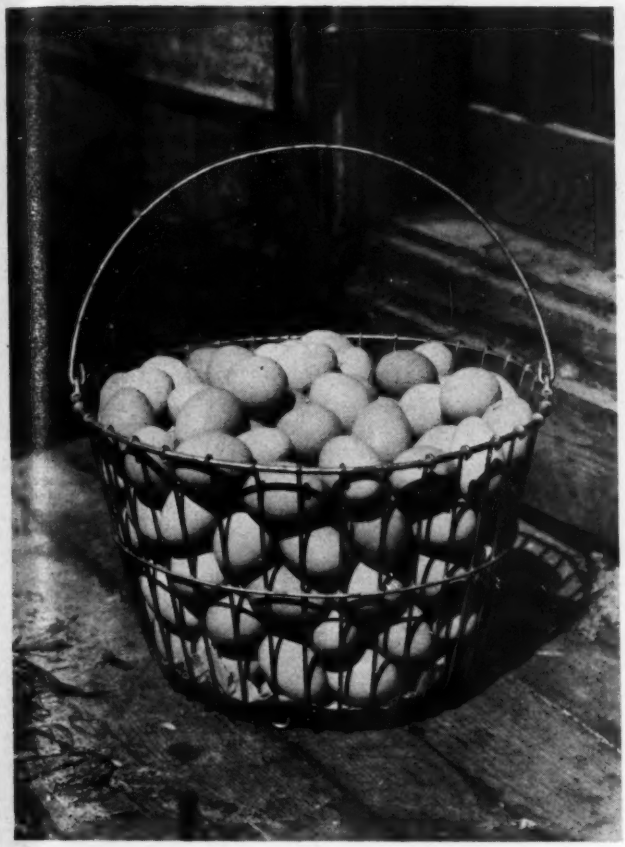
• • •

Our representatives are prepared to discuss the special advantages of B_2O_3 in glass.

PACIFIC COAST BORAX COMPANY

51 MADISON AVENUE, NEW YORK 10, N.Y.

GLASS COLORS by PEMCO



... justify "putting ALL your eggs in one basket"

Large enough to care for ALL your wants! Staffed for perfect service! . . . . . and stressing the experience of top flight technicians, the Glass Color Division of Pemco offers a central point of purchase of enormous time-saving convenience. There is always a "reserve" at Pemco ready to supply any unusual demand or to close the breach of any normal breakdown. Add to this the uniformity, the great durability and the long range economy of Glass Colors by Pemco and the advisability of establishing a contact where "one call does it all" immediately becomes apparent.

A letter, phone call or wire will bring you a more detailed profit story as to why it's to your advantage to centralize your purchases. Generous samples too, on request.

PEMCO CORPORATION

Baltimore 24, Maryland

GLASS COLOR DIVISION

BORIC OXIDE — ITS CHEMISTRY AND ROLE IN GLASS TECHNOLOGY . . .

(*Continued from page* 265)

TABLE VIII.

Composition of the Lead Borate Melt	Surface Tension dynes/cm.	Sign of Temp. Coefficient of Surface Tension
100% B_2O_3	79.5	positive
4.9% PbO	78.2	"
10.1% PbO	78.4	"
16.6% "	78.2	"
21.6% "	79.4	"
27.8% "	80.1	"
31.4% "	80.1	"
34.4% "	78.5	"
39.9% "	79.1	"
44.9% "	89.3	"
47.0% "	93.3	"
49.1% "	91.6	zero
51.3% "	103.0	negative
56.3% "	116.4	"
60.9% "	129.8	"
66.4% "	144.2	"
70.7% "	152.9	"
75.5% "	160.3	"
80.0% "	163.0	"
82.0% "	162.0	zero
84.1% "	162.8	positive
86.0% "	162.2	"
88.1% "	162.2	"
89.8% "	160.4	"
91.1% "	157.4	"
94.0% "	151.0	"
96.0% "	144.5	"
97.9% "	132.3	"
100.0% "	132.0	"

PbO again is positive because this compound forms asymmetrical PbO_4 groups where the Pb^{2+} is the top and the four oxygen ions are the corners of the basis of a tetragonal pyramid.

The system B_2O_3-PbO shows a region of negative temperature coefficients of surface tension in spite of the fact that the two end members have positive coefficients. The work of Shartsis, Spinner and Smock not only helps us to understand the role which small additions of boric oxide play in the surface properties of glass, but must be considered one of the finest and most revealing contributions to the atomic structures of fused salts and glasses.

The conclusions drawn by the authors concerning the chemical composition of the surface layer are supported by their studies on the volatility of these mixtures.

L-O-F APPOINTMENT

The appointment of Clair A. Parish as assistant to Edward M. Everhard, general manager of distributor sales for Libbey-Owens-Ford Glass Company has been announced. Mr. Parish will be in charge of the company's export sales.

Associated with L-O-F since 1943, Mr. Parish has handled details of export business, as well as domestic plate glass orders, in his work with the order department.

INVENTIONS AND INVENTORS . . .

(*Continued from page* 268)

This machine is in the form of a hand operated press and Fig. 4 is a vertical section through the pressing implements. A pedestal 15 carries a base plate 19 which has an overhanging arm provided with a lever and gear meshing with a rack 24 by which the upper plunger mechanism may be raised and lowered. The lower end of the plunger 25 is shaped to conform to the bead 26 which has been previously attached to the lead 27. The lower end of the plunger has a socket 28 to receive the top of the lead 27 while the power end is inserted in a guide post 35. This post has a small central bore 36 to receive the reduced shank 37 of the output lead. The upper end of the post 35 slides in a cap 38 threaded into a cap 39 fixed in the base plate 19. The lower end of the post is attached to a plunger 41 which has a collar 42 carrying a handle 43. A spring 44 normally urges the plunger 41 to move upwardly so that the bead 26 is above the burner plate 46 and positioned in line with burners which do not show in the figure. In this position the output lead and its shank 37 are placed in the post 35.

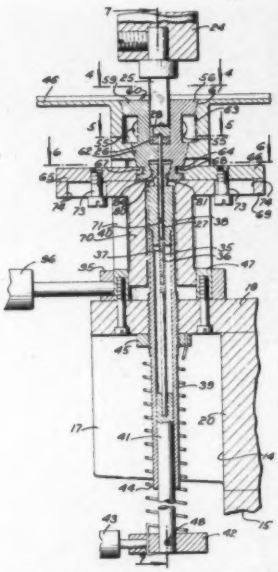


Fig. 4. Machine for Molding Beads on Wire.

Burners are also provided to heat a four-part die 60 by means of ports 55. The lower ends of the die 60 are grooved at 64 so that the die may be opened while the parts are held in a fixed plane and also the die may be moved vertically as a whole. A handle 96 connected to a tubular member 70 provides means for moving the parts.

In operating the machine, the output lead 27 having the glass bead already attached, is inserted in the post 35 while it is in raised position. The handle 43 provides means for moving the bead down into the flame where it is softened and then into the die 60 which is open at this time. The plunger 25 is then brought down to form the bead in the closed die. The die is next raised and opened, leaving the finished article ready for removal.

The following references are of record in the file of this patent: United States Patents: 614,843, Criggal, Nov. 29, 1898; 851,904, Steimer, Apr. 30, 1907; 1,789,014, Millar, Jan. 13, 1931; 2,195,483, Franke, Apr. 2, 1940; and 2,347,421, Little, Apr. 25, 1944.

Owens Burn-off Method. Fig. 5. .Patent No. 2,439,754. This method was invented by Harold R. Schutz, who assigned it to Owens-Illinois Glass Company. By this method the moil may be burned off from ware such as tumblers and the wall thickness and size of the bead may be regulated as desired.

In Fig. 5 a tumbler 10 having an attached moil 11 is placed in a rotary chuck 12 mounted on a vertical shaft

(*Continued on page* 286)

NEW ORLEANS WELCOMES THE GLASS INDUSTRIES!

HOW TO CUT COSTS
by locating your new plant
IN NEW ORLEANS

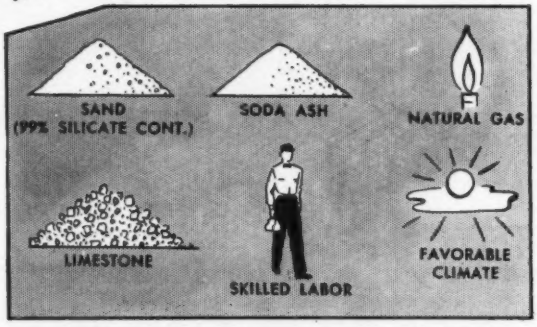
More Available raw materials, more economical transportation, more accessible markets... mean more profitable operation.

MARKETS are bigger and more accessible from New Orleans. Not only the 30,000,000 people in the 10-state Southern Market, but the entire mid-continent area and Latin America can be quickly and economically reached from the South's largest, most prosperous city.

TRANSPORTATION is more economical—both for your nearby raw materials and for your finished product. A network of inland waterways, a port second only to New York in activity, efficient rail and air transportation are right at your door.

TAXES are lower, with a 10-year exemption plan for new or growing industries.
CLIMATE is healthful, free of extremes, beneficial to all-year, efficient production.
LABOR is plentiful, skilled, dependable. Lower living costs are conducive to better labor relations.

At your request, our representative will call on you.



RESOURCES for the manufacture of glass products abound in the New Orleans area: sand from two nearby sea terrace; soda ash from Baton Rouge or Lake Charles, limestone within 200 miles by low-cost barge service—and unrestricted, year 'round availability of the ideal fuel—natural gas.

SEND FOR YOUR COPY
of our industrial study, "Manufacturing Opportunities in Glass Products in New Orleans". Address: Dept. 51-A Greater New Orleans, Inc., 1024 Maison Blanche Bldg., New Orleans 16.

GREATER
NEW ORLEANS

INVENTIONS AND INVENTORS . . .

(*Continued from page* 284)

13. The tumbler is held in position by a suction plate 14. The shaft is mounted in a bracket 17 carried by a vertically movable support 18. A bracket 19 carries a burner

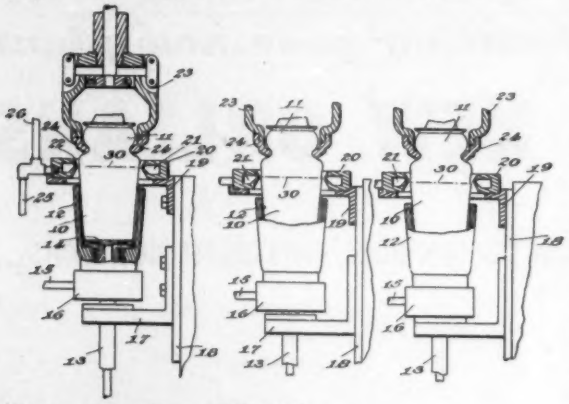


Fig. 5. Owens Burn-off Method.

ring 20 by which a flame may be directed against the tumbler. The moil is held by a gripper 23 having jaws 24 which rotate at the same speed as the chuck.

In operation, the tumbler is rotated while a flame is projected against it along the line 30. As the glass is softened along this line, it is stretched either by lifting the gripper 23 or by lowering the chuck 12, thus producing a narrow zone of thin glass as indicated in the central part of the figure. The chuck is then suddenly dropped a short distance while the gripper remains stationary so that an increased stretching force is applied to the heated zone. The flame from the burner 20 at this time is slightly above the line 30. This results in the severing of the moil and causes a bead to form on the top of the tumbler. The supply of oxygen is at once cut off, leaving a soft "lazy" flame directed against the bead. This prevents undue enlargement of the bead. It will be understood that the final form of the edge of the tumbler may be regulated by proper control of the temperatures and speed and time of the movements.

The following references are of record in the file of this patent: United States Patents: 1,577,538, Parker, Mar. 23, 1926; 1,577,654, Parker, Mar. 23, 1926; 1,578,098, Schrader, Mar. 23, 1926; 1,645,991, Higgins, Oct. 18, 1927; 1,674,366, Kadow et al., June 19, 1928; 1,920,528, Butler et al., Aug. 1, 1933; 2,215,980, Schreiber, Sept. 24, 1940; 2,239,627, Schutz, Apr. 22, 1941; 2,270,152, Themak, Jan. 13, 1942; 2,334,001, Hapgood, Nov. 9, 1943; and 2,334,111, McNamaran et al., Nov. 9, 1943. Foreign Patents: 541,755, Great Britain, Dec. 10, 1941, and 735,412, France, Aug. 30, 1932.

CERAMIC ENGINEERING ACTIVITIES AT UNIVERSITY OF ILLINOIS

The spring semester in the Department of Ceramic Engineering at the University of Illinois recently got underway with an enrollment of 94 undergraduate and 32 graduate students.

GLASS MACHINERY COMPANY

FAIRFIELD, CONNECTICUT, U.S.A.

• THE ONLY CHEAP LABOR IS GOOD AUTOMATIC MACHINERY •

A List of

NEXT DOOR NEIGHBORS

. . . to Your Oklahoma Plant!

OKMULGEE
BALL BROTHERS
RUPPERT GLASS PRODUCTS, INC.
SOUTHWESTERN SHEET GLASS CO.
AMERICAN WINDOW GLASS COMPANY

SAPULPA
BARTLETT COLLINS COMPANY
LIBERTY GLASS COMPANY

TULSA
OVERMAYER-PERREM GLASS COMPANY

MUSKOGEE
BROCKWAY GLASS CO., INC.
CORNING GLASS WORKS

ADA
HAZEL-ATLAS GLASS COMPANY

BLACKWELL
HAZEL-ATLAS GLASS COMPANY

HENRYETTA
PITTSBURGH PLATE GLASS COMPANY

SAND SPRINGS
ALEXANDER H. KERR & COMPANY

Pretty nice people, too. They know how to turn out a nice job of glass production . . . at a profit. They use the abundant supplies of native glass sand, limestone, dolomite, coal, low cost power, and natural gas. (They sleep nights because there's no shortage of gas.)

They like Oklahoma because it's the center of the 9 billion dollar Southwestern glass market, and the location saves them money on west coast shipping.

They breathe easily because Oklahoma has one of the lowest strike records in the nation and one of the highest percentages of native born white labor. They see their lawyers less because Oklahoma corporate laws are now similar to Delaware's! And when they leave their plant for the golf course, they step into clean air, and room in which to breathe it. (60.5° F. average mean temperature.)

You'll like your neighbors (and the potential profits) of an Oklahoma plant. Remember, facts* prove, Oklahoma's "OK" for the glass industry.

OKLAHOMA

PLANNING and RESOURCES BOARD
STATE CAPITOL BUILDING
OKLAHOMA CITY, OKLAHOMA

***FREE — FOR BUSINESS EXECUTIVES** "Factors Favoring Business Expansion In Oklahoma." Interesting—informative. Write for it—Now! Special confidential report relating to your business will be made if requested.

FOR SALE

GLASS PLANT, CHICAGO HEIGHTS, ILLINOIS

By order of the United States District Court for the Northern District of Ohio, Western Division, Owens-Illinois Glass Company offers for sale as a unit all real estate, buildings, machinery, production equipment (not including molds), tanks and furnaces (except experimental machinery and furnaces) located at Chicago Heights, Illinois, and which were a part of the assets acquired by Owens-Illinois Glass Company from Kimble Glass Company on July 1, 1946.

In accordance with the order of the Court such property is offered for sale for cash to any purchaser approved by said Court, subject to prior sale, at the fair market value of said property as a glassware manufacturing plant, as determined by an appraisal made by The Lloyd-Thomas Company, which said appraisal has been duly filed with the Clerk of said Court at Toledo, Ohio., where it may be inspected. Additions and improvements made to the property described above since July 1, 1946, and prior to consummation of sale are not included in the appraised value aforesaid but are offered for sale as a part of the unit for an additional consideration equal to the cost thereof to Owens-Illinois Glass Company.

In connection with the sale of the property and additions and improvements thereto above described, Owens-Illinois Glass Company will assign or cause to be assigned to the purchaser thereof for the consideration hereinafter set forth, all its rights in and to the following machinery and equipment leased from Hartford-Empire Company situate on said premises on July 1, 1946, to-wit:

4—4 head I S machines with feeders, revolving tube drives and motors, and variable speed drives and motors

1—5 head I S machine with same

2—36" x 74' lehrs, gas fired with top vertical discharge, motor driven steel plate exhaust fan, and all regular equipment

The consideration to be paid by the purchaser to Owens-Illinois Glass Company for the assignment of its rights in the leased machinery aforesaid shall be cash in such an amount as will reimburse Owens-Illinois Glass Company for a fair proportion of any and all payments made in connection with said leased machinery by Kimble Glass Company or Owens-Illinois Glass Company which may be considered as costs of installation, advance payments for minimum annual royalties, license fees, parts, insurance and taxes.

In the event of such sale, possession will be delivered not later than six months after the consummation of such sale to a purchaser approved by the said Court.

Address all inquiries to

Owens-Illinois Glass Company
Attention: F. G. Morfoot
P. O. Box 1035, Toledo 1, Ohio

BETTER RAW MATERIALS FOR THE GLASS INDUSTRY . . .

(*Continued from page* 252)

from the non-magnetic stream of pure sand.

In the case of magnetic drums or pulleys, larger diameter rolls are used and the sand is usually applied on the top portion of the drum or carried over the drum by means of a non-magnetic steel belt. In this manner the sand comes in contact with the magnetic field for a longer period of time and is prevented from bouncing. Then if a knife edge is added so that it separates those particles which are slightly deflected from the main sand stream, very effective separation is possible. In each type of magnetic separator the amount of sand treated per hour is very small. For example, a 30" face drum about 20" in diameter will treat only 2 to 3 tons of sand in one hour. The induced roll separators are of similar capacity for a comparable size. Larger capacity can be obtained by increasing the length or face of the drum or rolls.

By magnetic separation from 5 to 10 per cent of the sand may have to be discarded which increases the cost, but not seriously if compared to prevailing prices of available extremely low iron sands.

Lime, feldspar and other raw materials may be similarly treated but no data are available on the effectiveness of such purification. Manufacturers of fine glassware, whatever type of product it may be, must resort to some means of purification until better raw materials can be purchased and their quality guaranteed.

There exists a great need for some means of setting up standards or specifications for all raw materials used in the glass industry and perhaps other branches of the ceramic field. Some European producers of raw materials have set up their own standards which they strive to meet. Illustrations of these are shown in Tables III* and IV* and denoted as "Trade Marks." Each producer has his own "Trade Marks" and these may not necessarily correspond to those of another.

The glass industry can, by proper organization, set up

TABLE III

According to Keppler, the following rules concerning the permissible maxima of iron contamination can be adhered to, provided the other raw materials are low in iron.

0.010	Max. Fe_2O_3	for ultraviolet transmitting and optical glasses.
0.015	" "	for finest crystal glasses.
0.020	" "	for ordinary crystal and cut glass.
0.030	" "	for opal and mirror glass.
0.050	" "	for bulbs and tubing.
0.10	" "	for plate glass mirrors and best window glass.
0.20	" "	for ordinary window glass.
0.30	" "	for half white—double strength window glass.
0.50	" "	for half white—single strength window glass.
Over 0.50	Fe_2O_3	—for bottle glass, green glass, and black glass.

TABLE IV

Trade Marks for Sands from Dörentruper Sand and Clay Works

Trade Mark	Maximum Fe_2O_3	Recommended for the following:
O.P.C.	0.010	Optical and U.V. transmitting glasses
O.C.	0.013	Lead crystal, cut glass, pressed glass and tubing
IB	0.020	Tubing, mirrors, and window glass
IIB	0.035	Half-white, tubing, window glass and sodium silicate

standards and specifications for all raw materials and urge or even demand that the producers of raw materials prepare their product to meet these required specifications.

Some work along this line has been done in the case of feldspar whereby the alumina, silica, and iron content is specified for each grade of feldspar. This was a great step forward, but similar specifications are needed for all other glass making materials. Having such grades to choose from the glass manufacturer can obtain raw materials to produce the product desired, and have assurance of consistent results from day to day.

Once having established such grades and the corresponding specifications, producers of these materials would tend to become more alert and induced to provide raw materials in the top brocket of the grading system.

We believe that a committee sponsored by the American Ceramic Society should write such specifications. This committee would have a great deal of influence upon raw material producers, much more so than individual plants searching for a better raw material.

---

*Tables I, III and IV taken from *"Rohstoffe Zur Glasserzeugung,"* Vol. 5 of In Einzeldarstellungen, by Prof. Dr. Karl Quasebart.

CONVECTION CURRENTS IN A GLASS TANK . . .

(*Continued from page* 261)

"The process of homogenization during the fusion of glass" by H. Jebsen-Marwedel. *Angew. Chem.* 7-5-1937, pp. 400-406.

The direct study of convection currents on glass factory tanks

B—Study by chemical analysis or other means.

"The determination of glass currents in tanks by means of barium oxide" by E. J. Bowmaker and J. Cauwood. *Jour. Soc. Glass Technol.* 15, 1931, pp. 128-40. See also *Glastechn. Ber.* 9, 1931, p. 447.

"The use of barium oxide for the study of the flow of glass in tanks" by W. Hampton. *Jour. Soc. Glass Technol.* 15, 1931, pp. 251-253. Summary: *Glastechn. Ber.* 10, 1932, p. 653.

"The significance of analysis in the determination of glass currents" by A. Thurmer. *Glashutte,* 63, 1933, pp. 768-70. Summary: *Glastechn. Ber.* 12, 1934, p. 205.

"Tracing flow in glass tank furnaces" by F. L. Bishop. *Jour. Amer. Cer. Soc.* 11, 1945, p. 28.

The direct study of convection currents in glass-factory tanks

C—The examination of corrosion lines or coloration lines after the cooling of a tank.

"The theory of corrosion of tank blocks" by E. Arthur and A. McGee. *Glass Ind.* (N.Y.), 7, 1926, pp. 107-109. Summary: *Glastechn. Ber.* 4, 1926-27, p. 191.

"Corrosion of tank blocks by shelving" by F. C. Flint and A. R. Payne. *Jour. Amer. Cer. Soc.* 9, 1926, pp. 613-17. Summary *Glastechn. Ber.* 4, 1926-27, p. 352.

"The wear of tank blocks" by Donald W. Ross. *Jour. Amer. Cer. Soc.* 9, 10, 1926, pp. 641-53.

"Phenomena which are produced in the interface between the molten glass and the refractory block" by A. Dietzel. Conference held in 1935 at the German Ceramic Society. (Extracts with 6 fig. in *Fachausschussber* DGG No. 38, pp. 2-4.)

"The flow of glass in Fourcault tanks" by J. Callinans. *Glass Ind.* 1935, Vol. 16, pp. 239-40-248. Summary: *Glastechn. Ber.* 13, 1935, p. 402.

"On the determination of the quantity of flow in Fourcault tanks" by G. Novaky. *Sprechsaal,* 58, 1935, pp. 228-31. Summary: *Glastechn. Ber.* 13, 1935, p. 285.

"The interpretation of corrosion images in glass factory tanks" by W. Schneekloth and W. Spielvogel. *Glastechn. Ber.* 14, 1936, p. 125.

"Procedure for study of glass currents in tanks" by W. Schneekloth and Spielvogel. *Glastechn. Ber.* 15-1-1937, pp. 1-14.

"Flow lines in a glass-melting tank determined by means of cobalt oxide and represented by color photographs" by Vernal W. Leng. *Jour. Amer. Cer. Soc.* 1, 1946, pp. 8-15.

Divers studies contributing to the knowledge of the distribution of convection currents

"Fundamental notions on the flow of heat through glass and walls" by G. McCauley. *Jour. Amer. Cer. Soc.* 8, 1925, pp. 492-504. Summary: *Glastechn. Ber.* 3, 1925-26, pp. 456-58, 12, 1934, p. 323.

"The transfer of heat in a glass-factory tank" by F. Jochin. *Glastechn. Ber.* March 1930, pp. 553-69.

"On the specific gravity of glass as a function of the temperature" by W. Hanlein. *Glastechn. Ber.* 10, 1932, pp. 126-30.

"The study on the point of aggregation and of transformation of glass by the measure of electrical resistivity" by W. Hanlein and M. Thomas.

"Gas heating and the transfer of heat in glass-factory tanks" by W. Schneekloth. *Glastechn. Ber.* 13, 1935, pp. 185-95.

"Transmission of heat in glass-factory tanks" by C. Cone. *Ceram. Stud.* July 1936, pp. 34-36-38-40-42.

"The thermal conductivity, convection and transfer of heat" by E. Schmidt. *Physikregelmasseg. Ber.* 1937, 5, pp. 101-17.

HOW CAN ISCO PRODUCTS WORK FOR YOU?

Potassium Carbonate, Hydrated 83-85%
ISCO DIAMOND I BRAND

Potassium Carbonate, Calcined 99/100%
(BAGS & BARRELS)

Sodium Silicofluoride
Beeswax
Ammonium Carbonate

ISCO
INNIS, SPEIDEN & CO.
117 LIBERTY STREET
NEW YORK 6, N. Y.
BOSTON · CINCINNATI · GLOVERSVILLE
CHICAGO · CLEVELAND · PHILADELPHIA

NATIONAL AIROIL BURNERS

MORE THAN

35 YEARS

AT YOUR SERVICE

Our experience in the design, development and manufacture of Oil, Gas, and Combination Burners for all types of industrial applications (including many in the Glass and Ceramic Industries) helps us meet and solve many combustion problems.

Our knowledge is *at your service*. . . . Consult us, today.

NATIONAL AIROIL BURNER COMPANY, INC.

1255 E. Sedgley Avenue, Philadelphia 34, Pa.
Texas Office: 2nd National Bank Bldg., Houston

BORAX and BORIC ACID

99½-100% Pure

POTASSIUM NITRATE
CAUSTIC SODA
SULPHUR

Stauffer CHEMICALS SINCE 1885

STAUFFER CHEMICAL CO.

420 Lexington Avenue, New York 17, N. Y. — 555 South Flower Street, Los Angeles 13, Cal
221 North LaSalle Street, Chicago 1, Illinois — 636 California Street, San Francisco 8, Cal
North Portland, Oregon — Houston 2, Texas

WAGE STRUCTURE IN GLASSWARE . . .

(Continued from page 256)

ers in large plants averaged about 8 per cent more than those in comparable jobs in small establishments while those in larger communities averaged nearly a tenth more than those in small cities. However, earnings in small cities were only about 5 per cent below those in medium-sized cities.

Below is a table showing the average hourly wage rates for selected plant occupations in glassware establishments during January 1947. Table I shows earnings by size of establishment.

Table II shows the average hourly wage rates in selected occupations by regions of the country, during January 1947.

Substantial groups of workers received supplementary income in the form of premium pay for overtime, but extra pay for late shift work was not widespread. Workers in two-fifths of the plants were on scheduled workweeks of more than 40 hours. More than a fifth of the plants had scheduled workweeks of 48 hours or more for men on the first shift.

Employment on the second and third shifts was about 40 and 30 per cent, respectively, of first shift employment. Shift rotation was extensive.

Nonproduction bonuses were reported in one-sixth of the plants but added less than a half of a cent to the average hourly rate of all workers. Paid lunch periods of more than 20 minutes were reported in about one-eighth of the plants.

About 85 per cent of the glass plants granted paid vacations to their plant and office workers. The typical vacation was 1 week for plant employees with a year's service and 2 weeks for office workers. Although office workers in about 9 per cent of the establishments studied received paid sick leave benefits for 2 to 3 weeks abence; no paid sick leave plans were reported for plant workers.

Over three-fifths of the plants had life insurance plans for their office and plant workers and one-eighth of the establishments studied had retirement pension plans for their employees.

BOTTLES THAT PACKED A WALLOP . . .

(Continued from page 258)

At hobby shows my display of Character Bottles has proved a sensation. The general public is not interested in the fine points of blown-in-mold historical flasks, but everyone is fascinated with the human interest appealing Character bottles—they gaze in rapt admiration at the bottle shaped as a Lobster, originally used to hold a red wine; the stippled glass Turtle, a brandy container, the Hand Holding a Pistol, a French wine holiday statuette, the Egyptian Sitting on a Drum, or the early Swedish Dog bottle with its hollow tail. They are amazed at the full length trick Sword bottle which only the owner can empty, the perfect amber reproduction of a Derringer Pistol and early American Automobile.

Yes, these bottles packed a wallop. They still do. No wonder Schenley decided upon a "Character" at the time of the World's Fair, a reproduction of the Empire Building. Today with the art of making glass containers at its best, we may still see many interesting new "Characters."

CLASSIFIED ADVERTISEMENTS

SITUATION WANTED

ARE YOU planning to expand your present glass plant facilities or having difficulty making good glass with your present equipment? I am fully qualified to assist you. Fourteen years of experience in the glass industry. Broad knowledge of glass tank construction and operation. Excellent references. Just returned from an assignment abroad. If you are in need of either a superintendent or consultant write Box 75, c/o The Glass Industry, 55 West 42nd Street, New York 18, N. Y.

HELP WANTED

ENGINEERS — DRAFTSMEN

Apply Arthur W. Schmid Company, 520 Investment Building, Pittsburgh 22, Pa. Replies will be treated in strict confidence.

FOR SALE

GLASS PLANT—We have a modern, nearly new, successful glass plant for sale, suitable for making pressed and art glass, also laboratory ware. A real buy. Principals only please; no agents. Jos. Dowler, Vineland, New Jersey.

1 28 Cu. Ft. RANSOME Dustproof Glass Mixer #14685 on steel frame complete with 15 hp ac 220 volt 60 cycle 3 phase fully enclosed Electro Dynamic electric motor #85153 with across-the-line starter switch extended track type power loading skip dustproof housing over discharge chute cut teeth on drum gear ring and pinion and with renewable liners throughout. This is a left hand unit. Price $4000.00 f.o.b. Monaca, Pa. The Phoenix Glass Company, Monaca, Pa. Mr. E. S. Kugel, Purchasing Agent.

CANADIAN GOVERNMENT ORDERS FREIGHT RATE INQUIRY

Arrangements are now being completed for the general freight rate inquiry ordered by the Canadian Government after the Board of Transport Commissioners had granted a 21% general freight rate increase to the Canadian railways. This move demanded a 30% boost with the increase already granted having gone into effect immediately and expected to raise the cost of shipping glass in Canada, especially in the west and east, with little, if any, changes anticipated for the central provinces of Quebec and Ontario.

A request by seven out of the nine provinces for a delay in carrying out the new general freight rate increases has been rejected. However, the Canadian Government has ordered an inquiry of the general overhaul rate structure which is believed likely to continue for a year or more.

As a result of the general freight rate increase of 21 per cent granted to the Canadian railways after one and a half years of litigation by the Board of Transport Commissioners, it is expected that the selling prices of glass may feel the effects in time with a slight increase in prices being anticipated and varying considerably in different regions across the country. It is relatively certain that such prices in central areas of Canada, like Quebec and Ontario, will not feel the effects as much as in the West and the Maritimes, depending on the rail haul. It is estimated that rail freight acocunts for approximately 3 per cent of the retail price of articles sold in Canada so that on an average across Canada the increase to consumers would be about one per cent or less in actual selling prices.

HAVEN Quality CASTINGS

TAILORED for the GLASS INDUSTRY

We have in stock for immediate shipment 6″ malleable bar stock 1/4″, 3/8″, 1/2″ diameter. For plugging molds, will pein readily.

One size, or assorted, quantities:

Up to 1000 pieces .....$0.05 each
Over 1000 pieces ..... 0.045 each
Over 2500 pieces ..... 0.039 each

H

Other bar stock available in sizes you want. Your inquiry will bring complete information on Alloy Iron Castings.

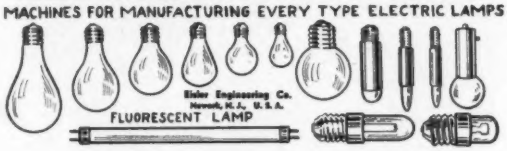
THE HAVEN MALLEABLE CASTINGS CO.
Dane & Knowlton Sts. Phone: Kirby 3581
CINCINNATI 23, OHIO

AUTOMATIC **EISLER** AUTOMATIC

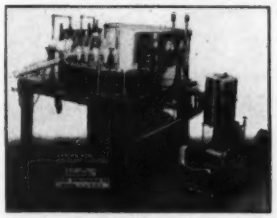
GLASS MACHINERY AND GLASS FORMING UNITS

FOR THE COMPLETE MANUFACTURE OF COLD OR HOT CATHODE LAMPS, INCANDESCENT AND FLUORESCENT LAMPS, RADIO — ELECTRONIC — NEON SIGN — TELEVISION TUBES, VACUUM FLASKS, EYE DROPPERS, etc.

SEALING MACHINES — STEM MAKING MACHINES
MACHINES FOR MANUFACTURING EVERY TYPE ELECTRIC LAMPS

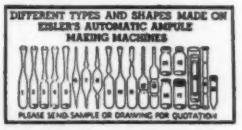


BULB BLOWING MACHINES — AMPULE MACHINES



36 HEAD AUTOMATIC EXHAUST MACHINE

Burners for All Types of Glasswork. Crossfires, Tipping Torches, Pyrex Glass Fires, Oxygen and Hydrogen Fires.


DIFFERENT TYPES AND SHAPES MADE ON EISLER'S AUTOMATIC AMPULE MAKING MACHINES
PLEASE SEND SAMPLE OR DRAWING FOR QUOTATION

CROSS FIRES

CHAS. EISLER

WE INVITE YOUR INQUIRIES

EISLER ENGINEERING CO., INC.
742 SOUTH 13TH STREET (near Avon Ave.) NEWARK 3, N. J., U.S.A.

WYANDOTTE STOCK PURCHASE SOLELY AN INVESTMENT

Increase in Wyandotte Chemicals Corporation's capital funds through sale of a minority holding in Wyandotte stock to The Solvay American Corporation, American affiliate of Solvay et Cie. of Brussels, represents no relationship between the two companies other than one of an investment nature, E. M. Ford, President of Wyandotte, has stated.

Under a plan approved at a meeting of Wyandotte stockholders, The Solvay American Corporation will make an initial investment of $12,750,000 in new Wyandotte stock. Subsequent stock purchases by Solvay will bring its total investment in Wyandotte to approximately $18,000,000.

DIAMOND ALKALI APPOINTMENTS

Three key promotions, including the appointment of a Vice President, a General Manager of the company's main plant and an Assistant Controller, have been announced by Diamond Alkali Company.

A. H. Ingley, who has been associated with the company for 28 years, has been named Vice President and is the first Vice President ever given specific charge of operations for Diamond. Mr. Ingley was formerly President of Diamond's wartime operation of Diamond Magnesium Company and from June 1946 until his present appointment, has been General Manager of the Painsville plant. M. O. Kirp succeeds Mr. Ingley as General Manager.

THE SHARP-SCHURTZ COMPANY

CHEMISTS AND CONSULTING ENGINEERS

FOR THE GLASS INDUSTRY

LANCASTER, OHIO U. S. A.

MOULDMAKERS

—To His Majesty—

KING GLASS

OVERMYER MOULD COMPANY

Factories at

GREENSBURG, PENNSYLVANIA
SOUTHGATE, CALIFORNIA
WINCHESTER, INDIANA

OMCO SCREW MACHINE PRODUCTS
SPRINGFIELD, OHIO

Then you'll want to investigate Ferro's acid-resisting, applied glass colors—with wide firing range, high gloss and good coverage. Write today for further details.

COLOR DIVISION
FERRO ENAMEL CORPORATION
4150 E. 56TH STREET • CLEVELAND 5, OHIO

High Grade
POTASH Feldspars

CLINCHFIELD SAND & FELDSPAR CORP.
618 Mercantile Trust Bldg., Baltimore 2, Maryland

GLASS SPECIALTIES

Transparent Colored Blown Sheet Glass
Solid Pot Opal Blown Sheet Glass
Flashed Opal Blown Sheet Glass
Colonial Antique Colored Glass
Heat-Ray Resisting (Cool Glass)
"TWIN-RAY"—the scientific illuminating glass.

HOUZEX

L. J. HOUZE
CONVEX GLASS CO.
POINT MARION, PENNSYLVANIA
New York Office: 110 West 40th Street
Chicago Office: 1597 Merchandise Mart
"IF IT'S MADE OF GLASS, ASK US FIRST"

of a
ny's
an-

om-
d is
op-
eni-
lag-
sent
ille
eral